TECHNOLOGY DEPT.

Gas Journal

VOL. 280 106TH YEAR. LONDON, NOVEMBER 17, 1954 NO. 4772. PRICE 1/3

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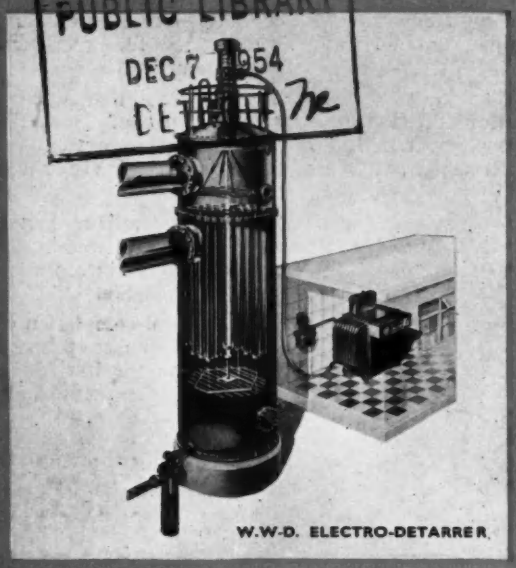
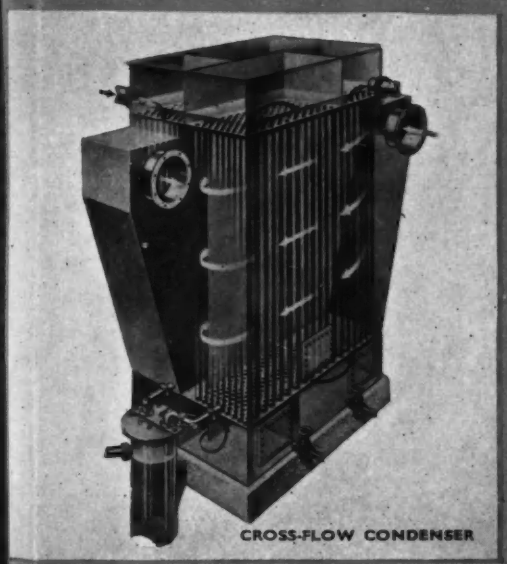
WHESSOE

TREATMENT PLANT FOR THE GAS & COKE OVEN INDUSTRIES

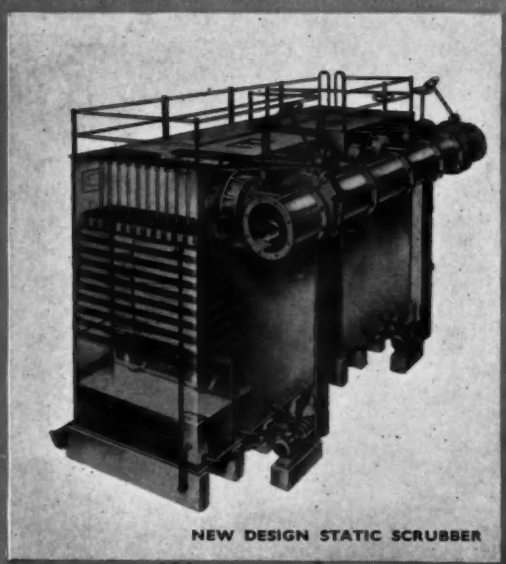
Whessoe design and build COMPLETE ANCILLARY PLANT for the treatment of all fuel gases. Many of these complete purification plants embody CONDENSERS, W.W-D. ELECTRO-DETARRERS and STATIC SCRUBBERS the features of which are illustrated on this page.



W.W-D. ELECTRO-DETARRER



CROSS-FLOW CONDENSER



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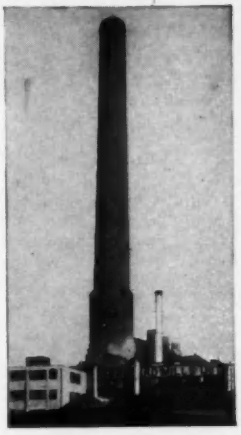
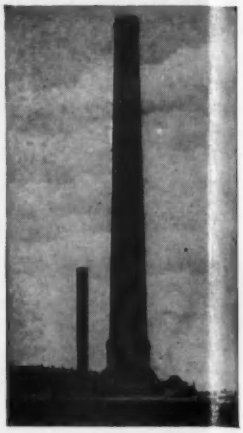
Left : Trial borings for reconstruction of Coventry Cathedral.





Two of the largest chimneys in the British Isles; on foundations of Francois Concrete Piles (left) and Francois Cementation Piles (Right)

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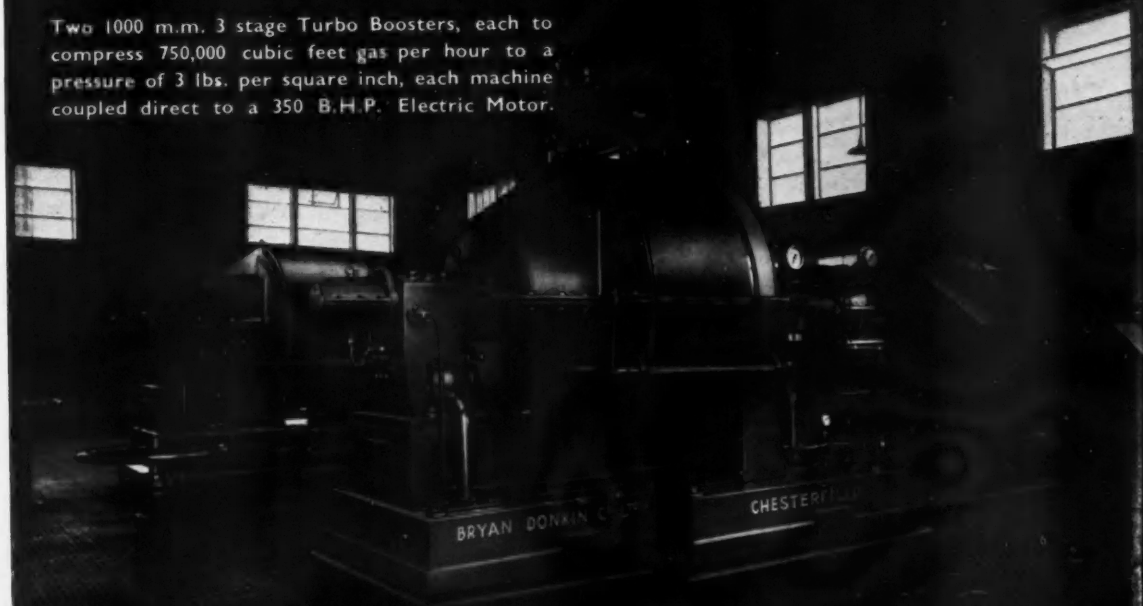

Illustration by courtesy Scottish Gas Board, Edinburgh

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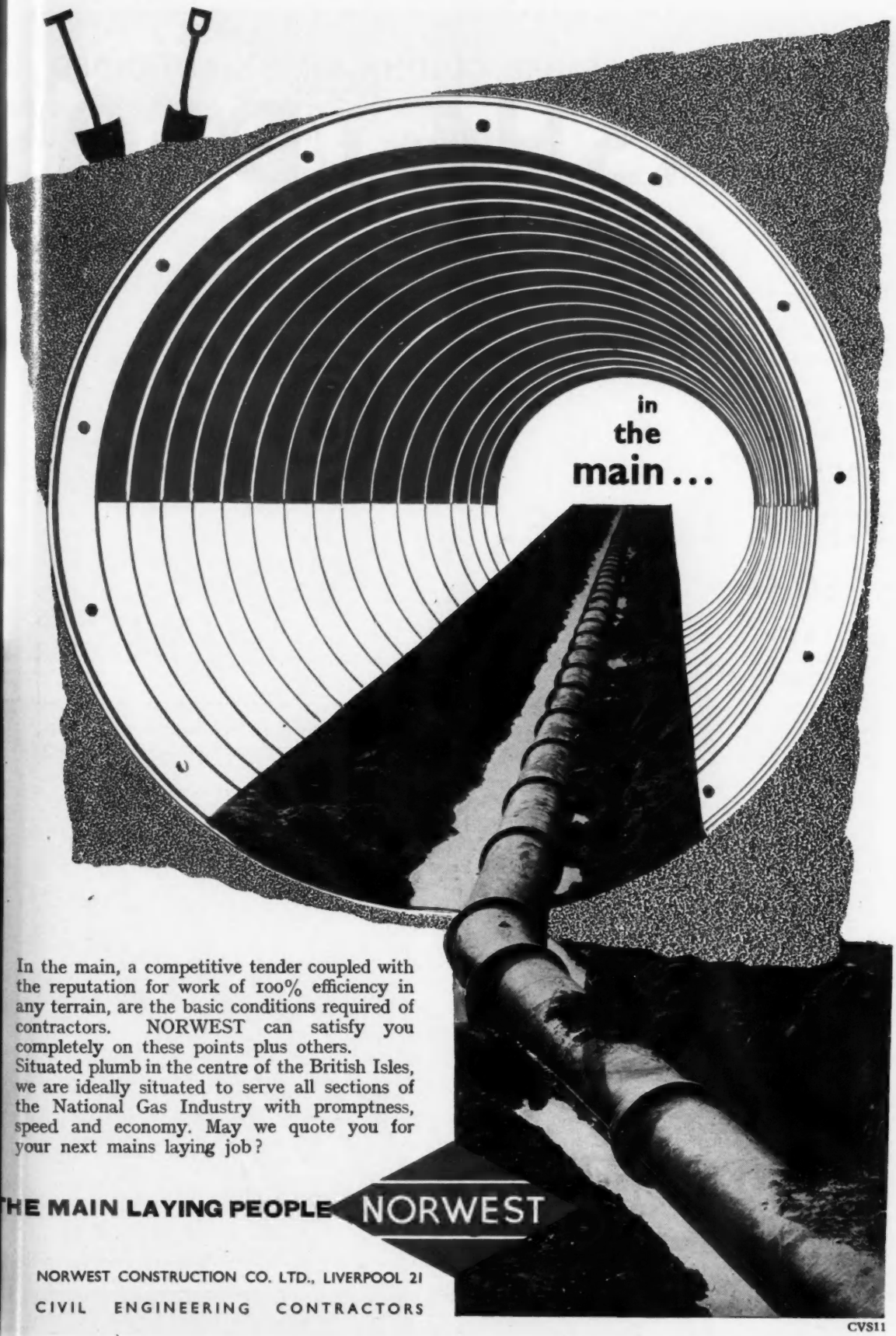

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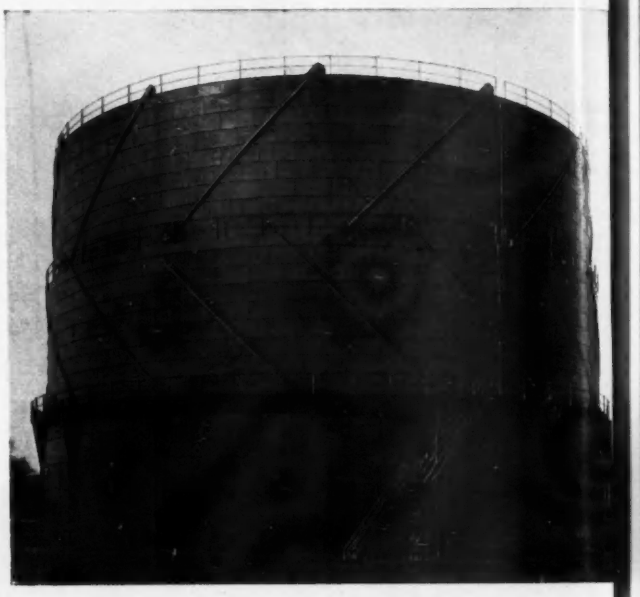

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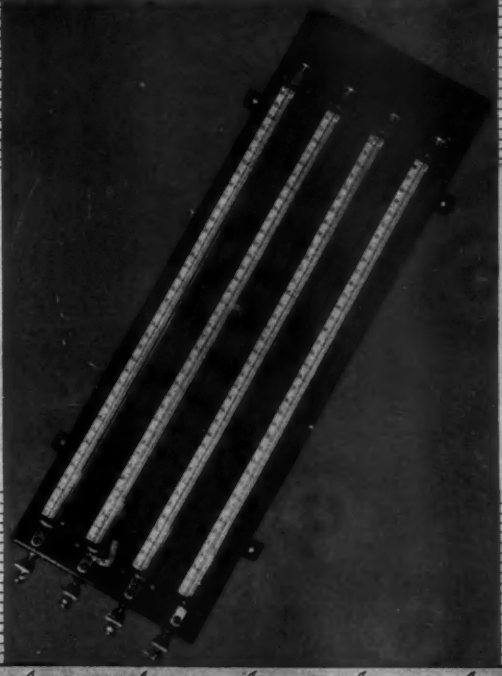

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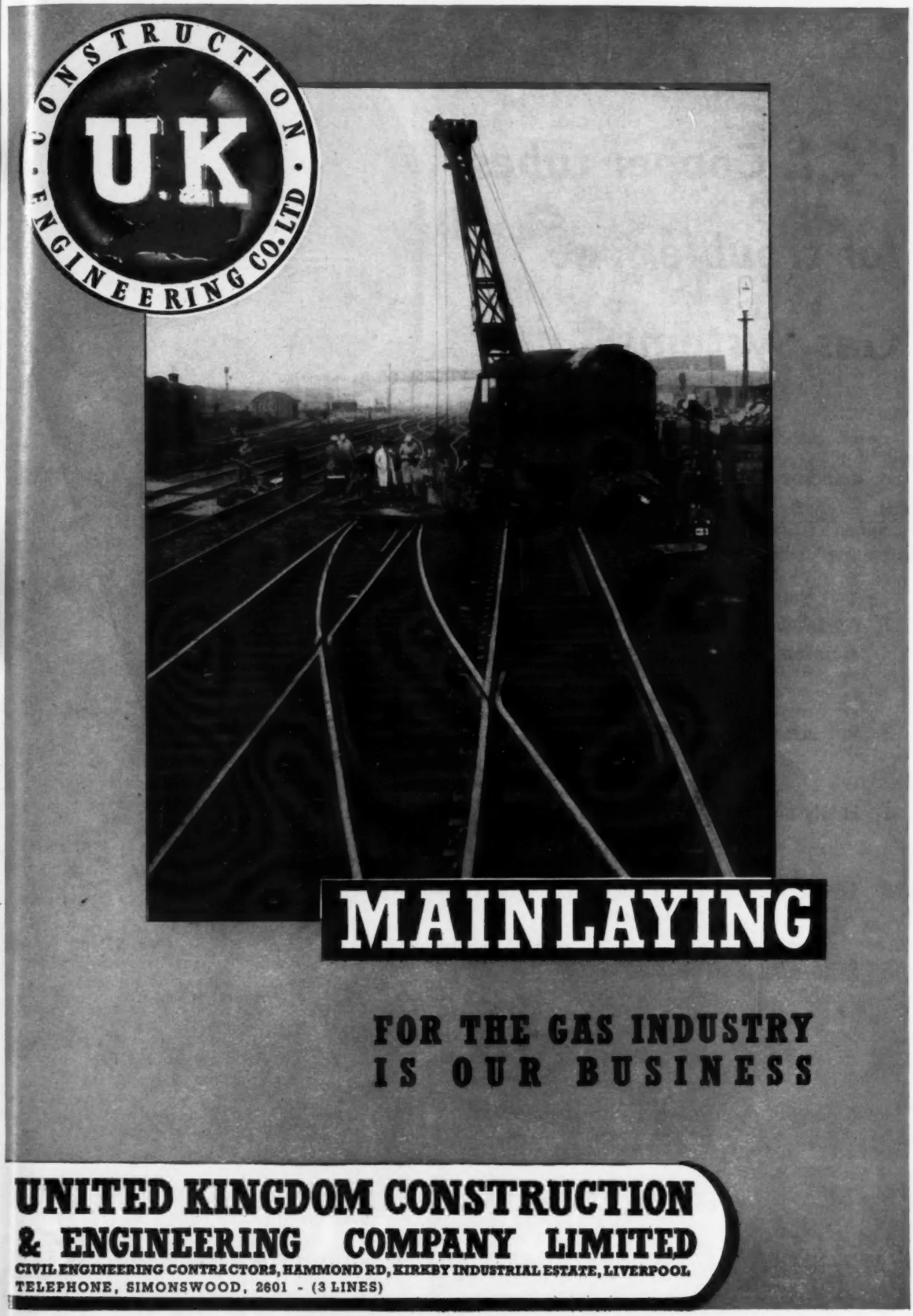
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4 **Strong in relation to their light weight.**

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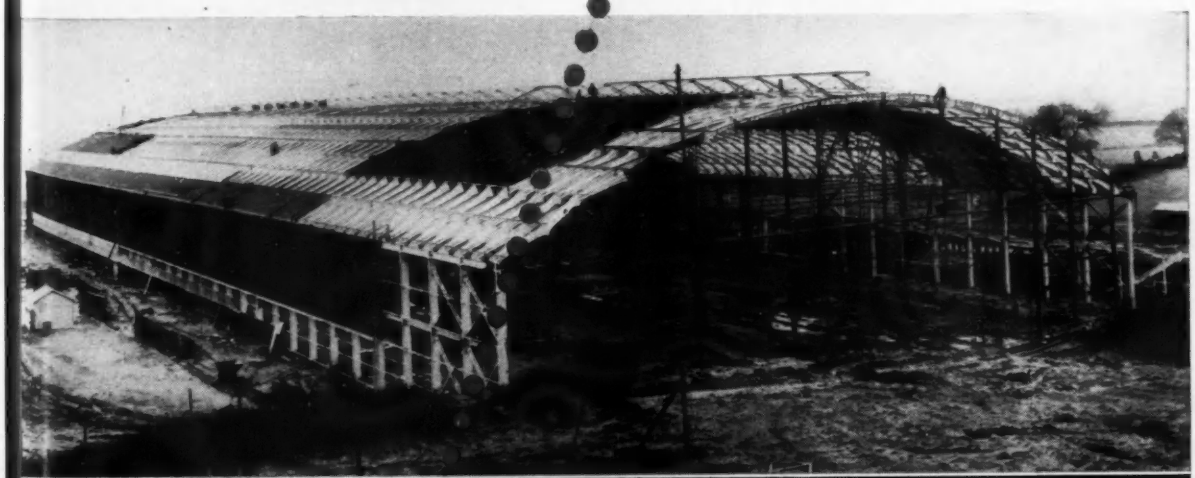

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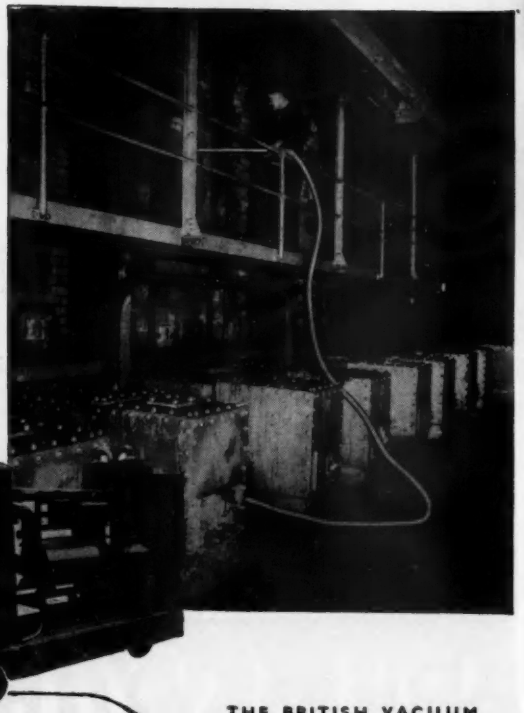
The illustration shows Redditch Gas works where a portable B.V.C. machine operates through an installed pipe system. Full particulars of these and other installations on request.



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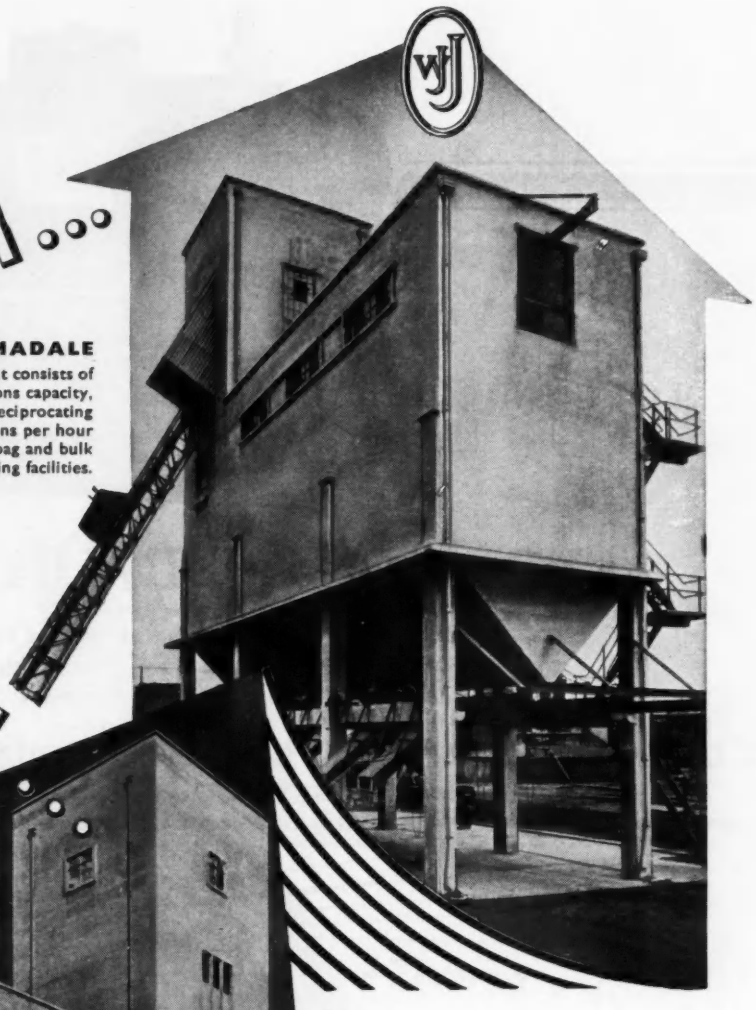

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the new Jenkins' coke plant, when completed, will have 1,000 ton storage capacity.

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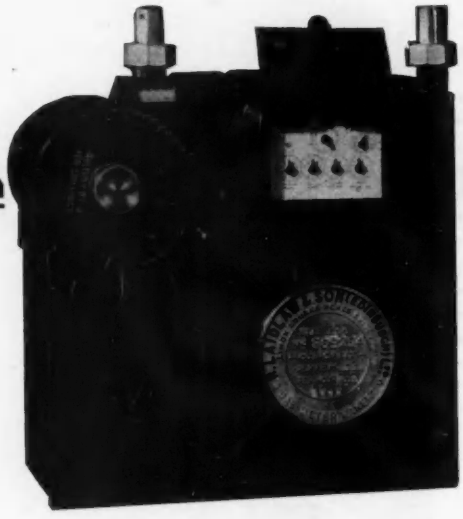

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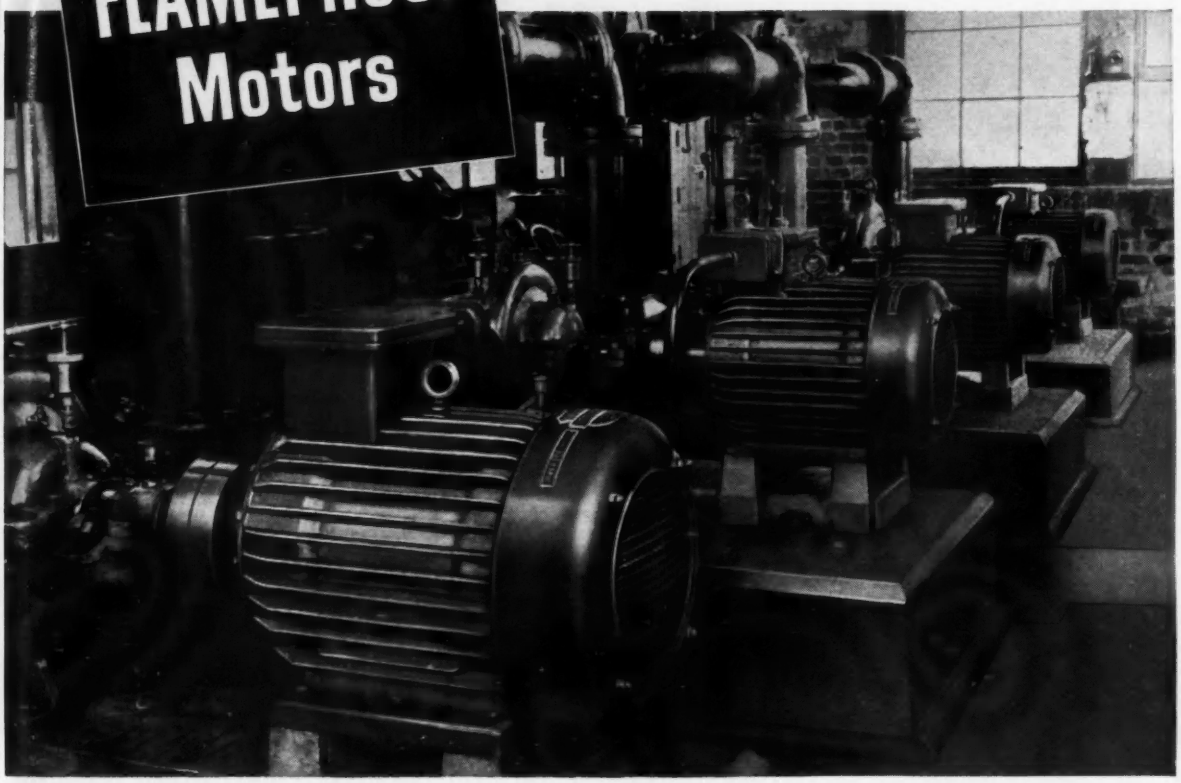
for all Explosion– and Fire-risk situations



4 L.D.C. 'Fankuld' Flameproof S.C.R. Motors, 20 H.P. 1,730 r.p.m. 220 V. 60 cy. 3 phase, driving benzol pumps.

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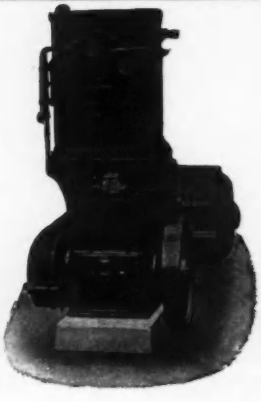

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pressures up to 5,000 lbs. per sq. in.

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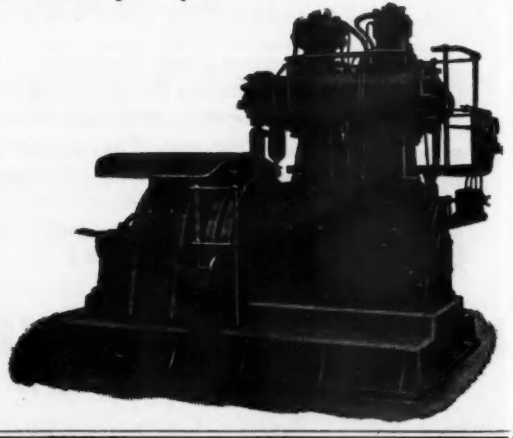
The compressor shown above has a capacity of 25 cu. ft. of free hydrogen per minute compressed to 3000 lbs./sq. inch. The illustration on the right shows a four-stage compressor with a delivered capacity of 200 cu. ft. of free town's gas per minute compressed to 5000 lbs. per sq. inch.



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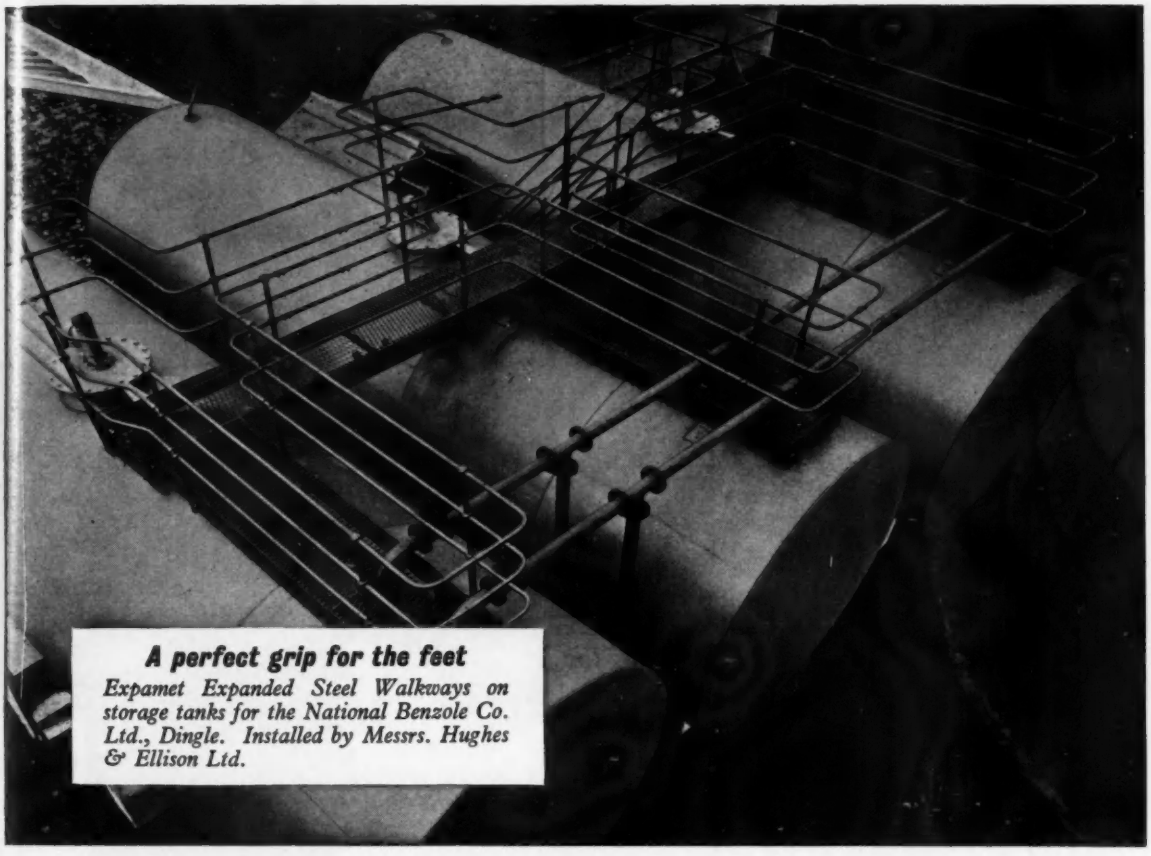

A perfect grip for the feet

Expamet Expanded Steel Walkways on storage tanks for the National Benzole Co. Ltd., Dingle. Installed by Messrs. Hughes & Ellison Ltd.

Walkways of Expanded Metal – yet another use for this very versatile material

ONE of the most outstanding things about Expanded Metal is its tremendous versatility. It has hundreds —*literally* hundreds—of uses and imaginative executives are finding, daily, new and unsuspected uses for it. The above photograph shows how neat and serviceable "Expamet" walkways look when erected. "Expamet" Openwork Walkway Panels are specially designed for catwalks, gantries, etc. They can be made with cutouts or openings to suit structural or other requirements; and they are strong, light and durable.

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"Expamet" walkway panels are extremely simple to fix. Standard fixing bolts are provided where necessary for fastening panels either to the main structure, or one to another. There's no need for drilling; and fixing bolts lie flush with the surface of the floor.

How then, can Expanded Metal help you?

Wherever there is a gap to be filled or an article to be made with open meshwork, industry is now turning to this adaptable and economical material. Quite likely, it can help *you*, also. Your best move is to talk over your ideas with us. Our engineers will gladly discuss it with you; or we will send you literature and samples. Please write or telephone.

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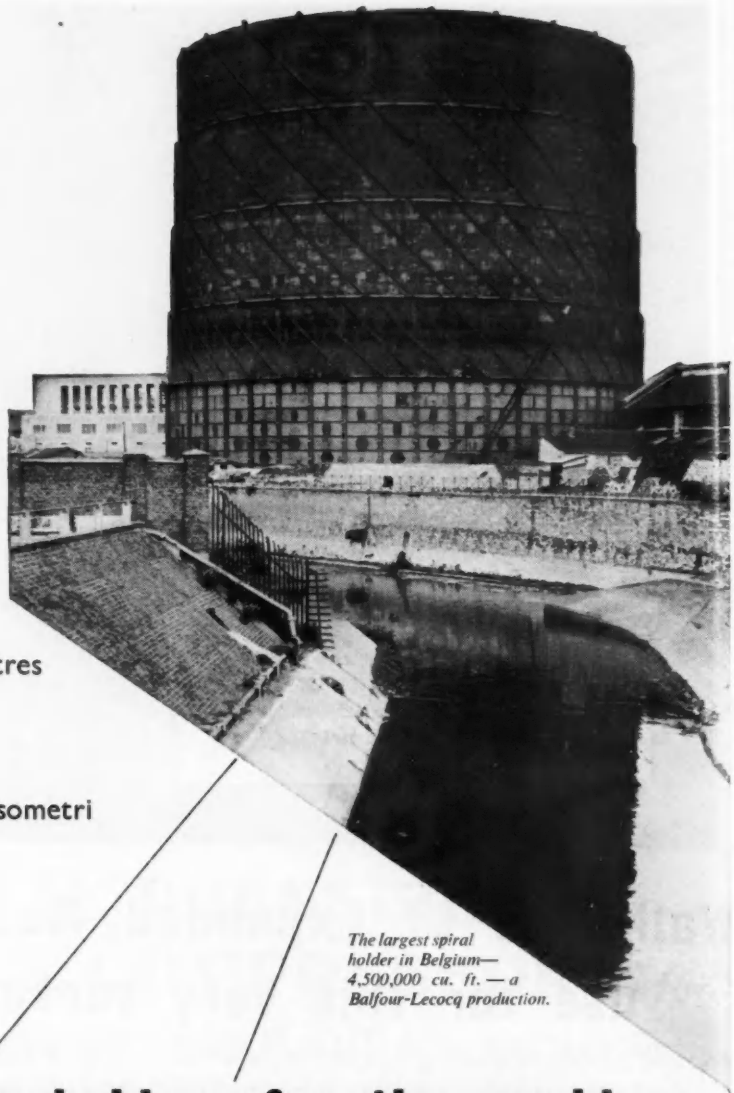

The largest spiral holder in Belgium— 4,500,000 cu. ft. — a Balfour-Lecocq production.

- Balfour gradi gasometre za ceo svet.
- Balfour construit des gazometres pour le monde entier.
- La ditta Balfour costruisce gasometri per tutto il mondo.

. . . or in other words . . .

Balfours build gasholders for the world . . .

Recently completed gasholders in Brussels and Milan, and those under construction in Jugoslavia and Scotland, bear testimony to the name of Balfour. The reason isn't hard to find. For over one hundred and forty years the Balfour organisation have been to the Gas Industry a source for the planning, manufacture and installation of a complete range of equipment.

Gas production, purification, storage, the recovery of by-products, whatever the problem this wealth of past experience and present ability is at your service.

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"consider this coraciiforme"*

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the colour of the sky, while its breast was scorched by the setting sun.
Not least of its colourful features is the brilliant red, long,
tapering bill, with which it spears the fish on
which it preys with sustained accuracy.

Sustained accuracy is vital also to a good gas meter : Alder & Mackay meters are subjected to meticulous tests to ensure a high standard of accuracy.

Here is the D.1/200 c. ft. ordinary meter intended to meet most domestic loads. Redesigned internally, it sets new standards of accuracy and longevity.

* The order Coraciiforme is a term of classification used by ornithologists, and includes the family of Kingfishers.

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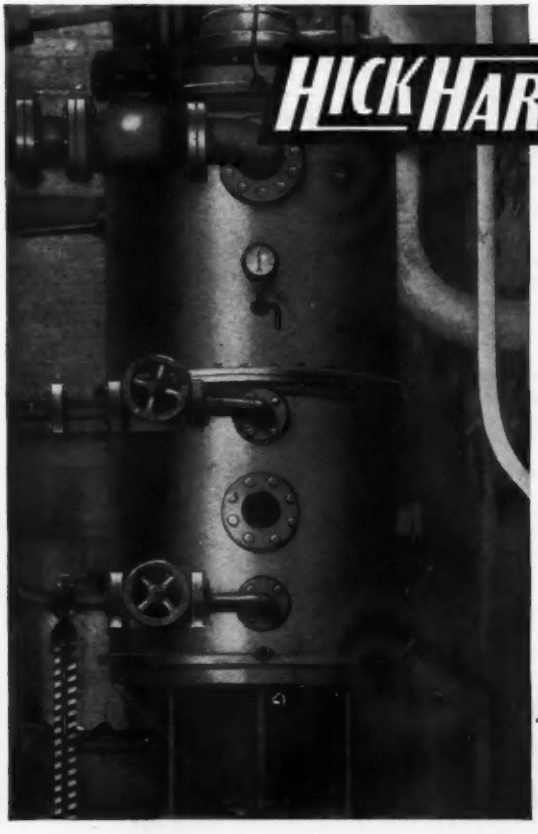

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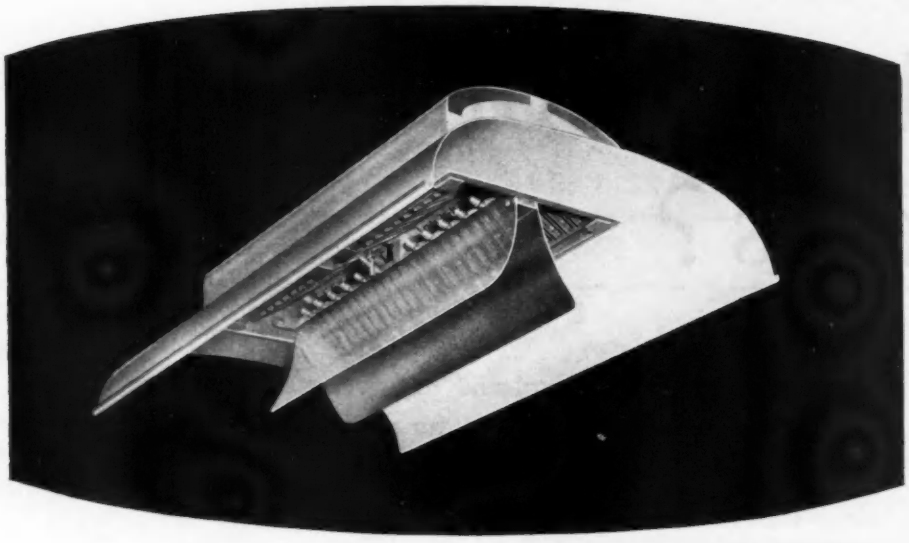

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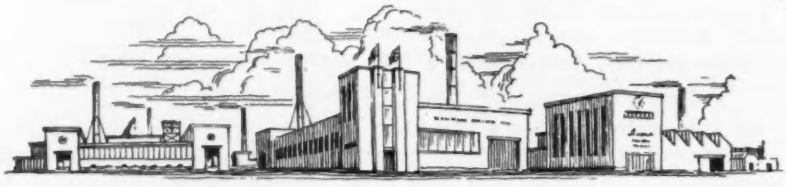

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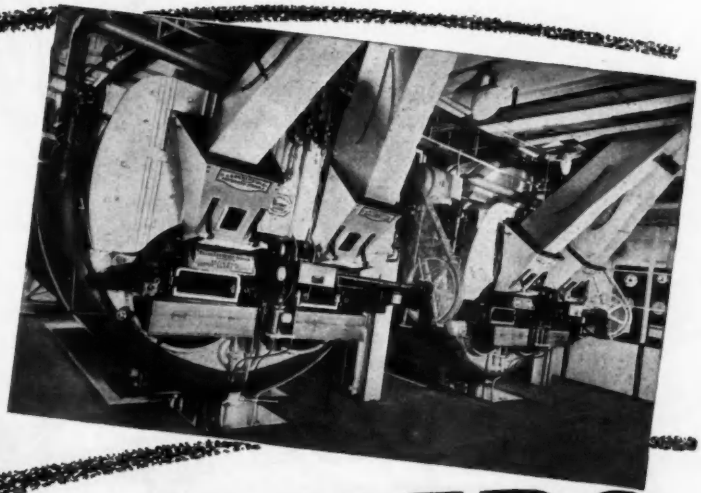

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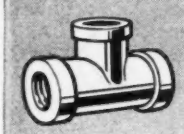

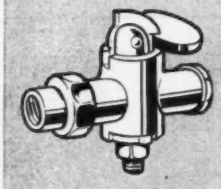

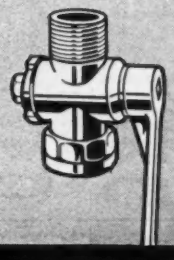

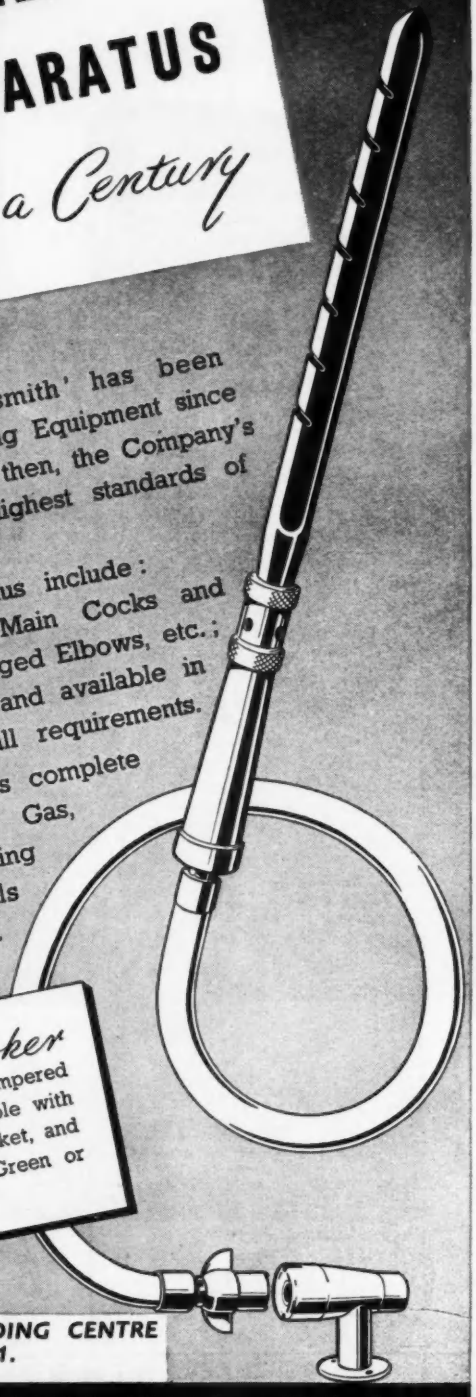

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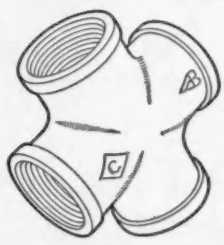

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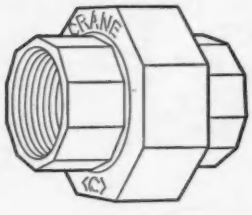

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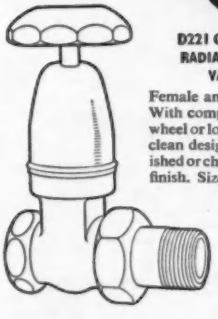

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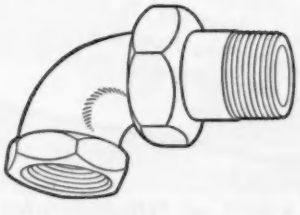

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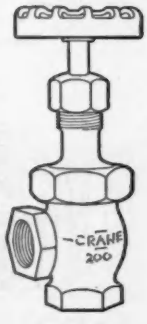

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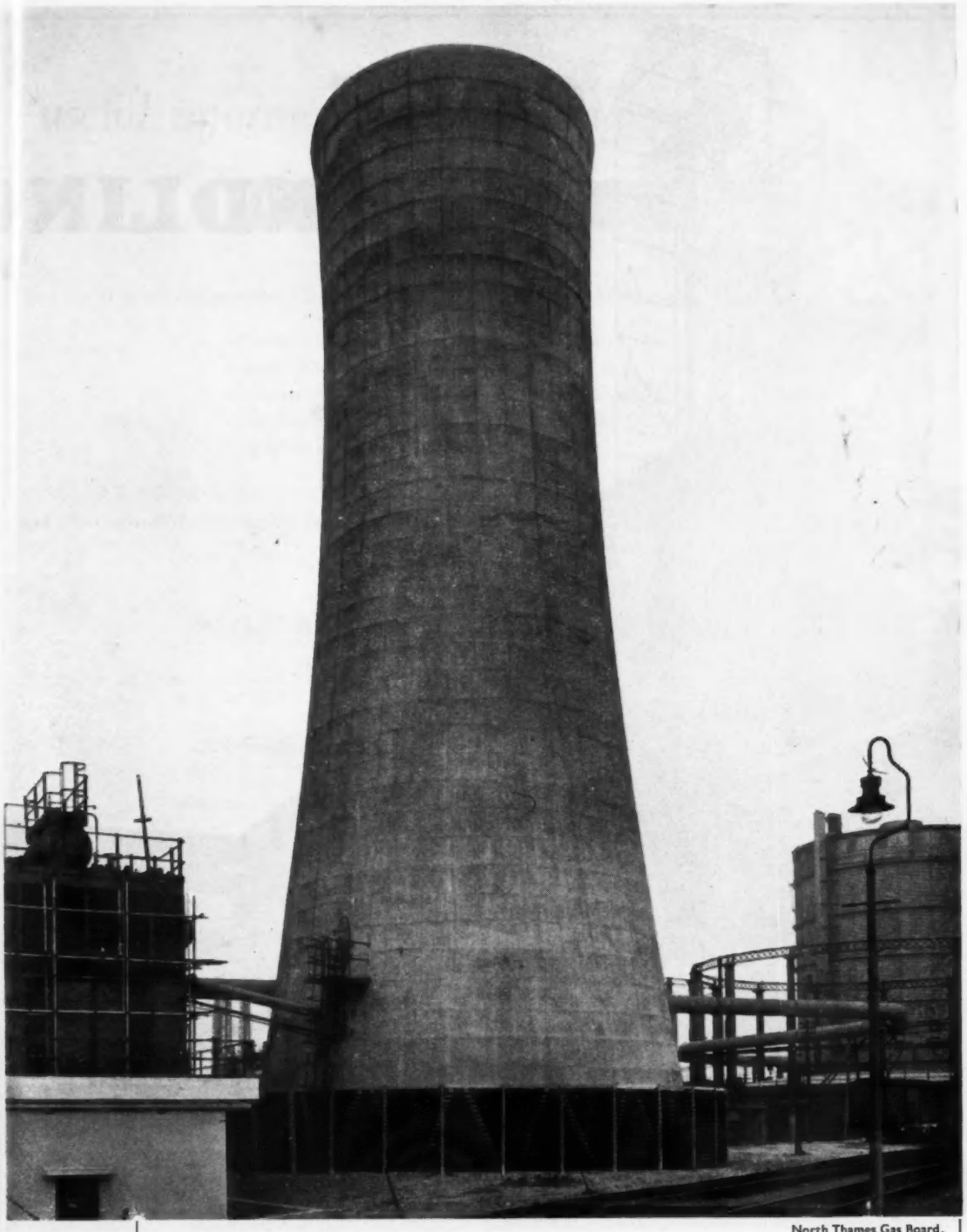

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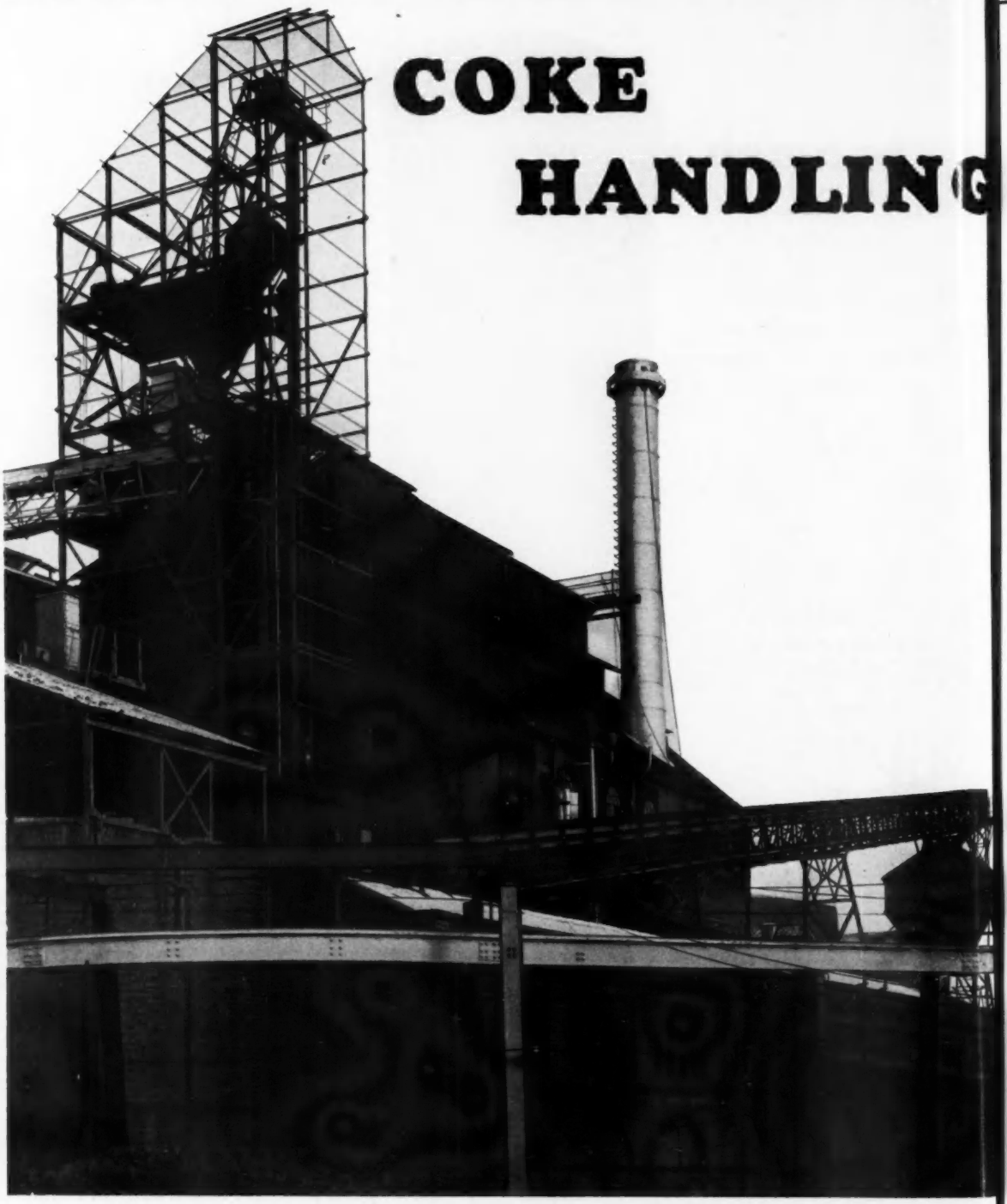

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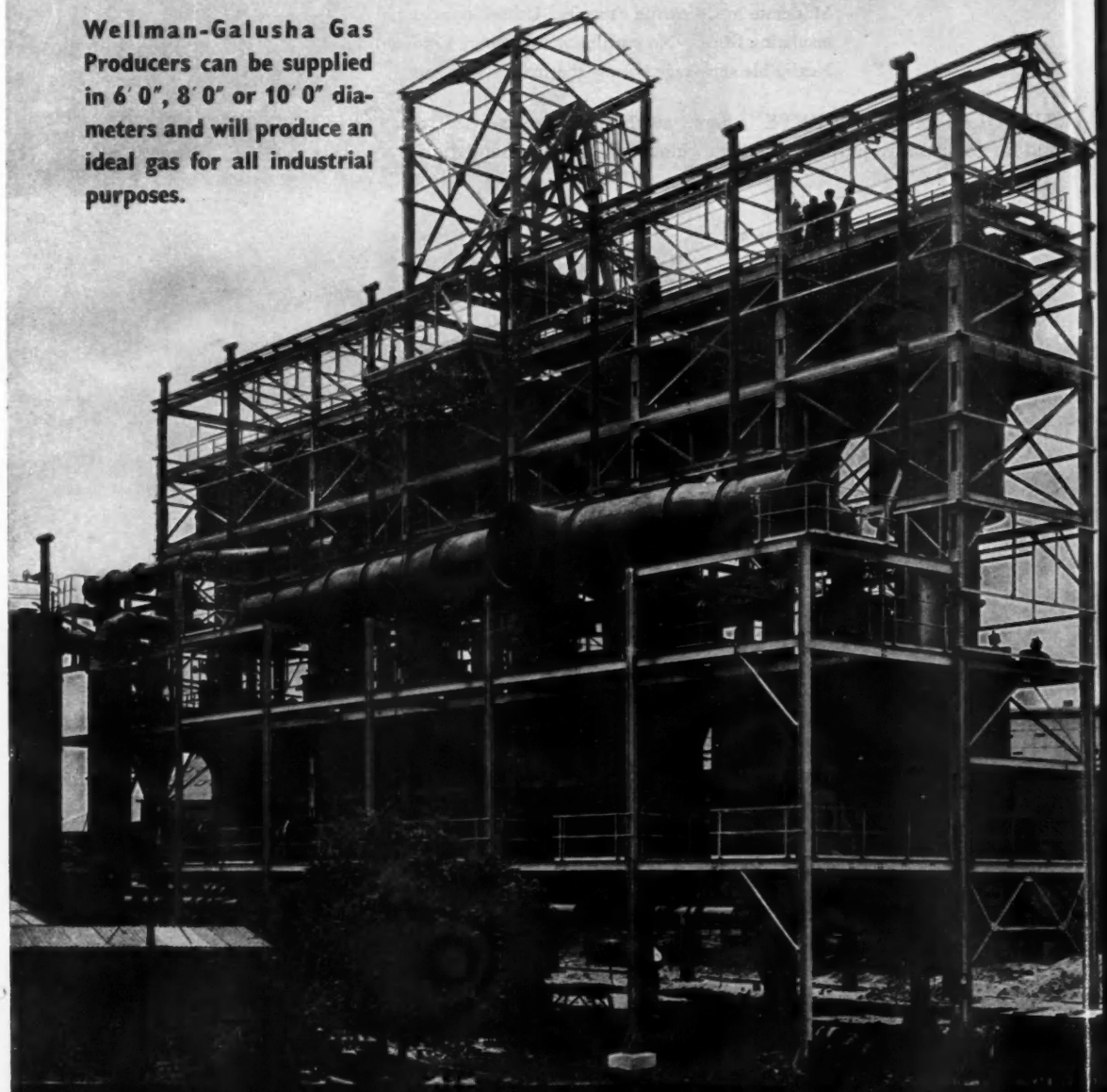

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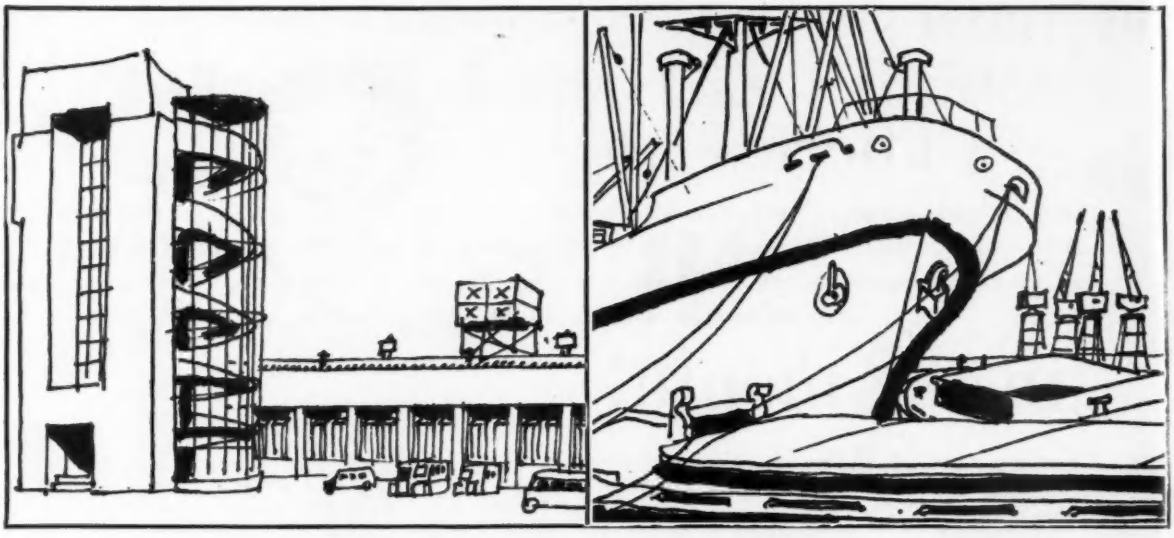

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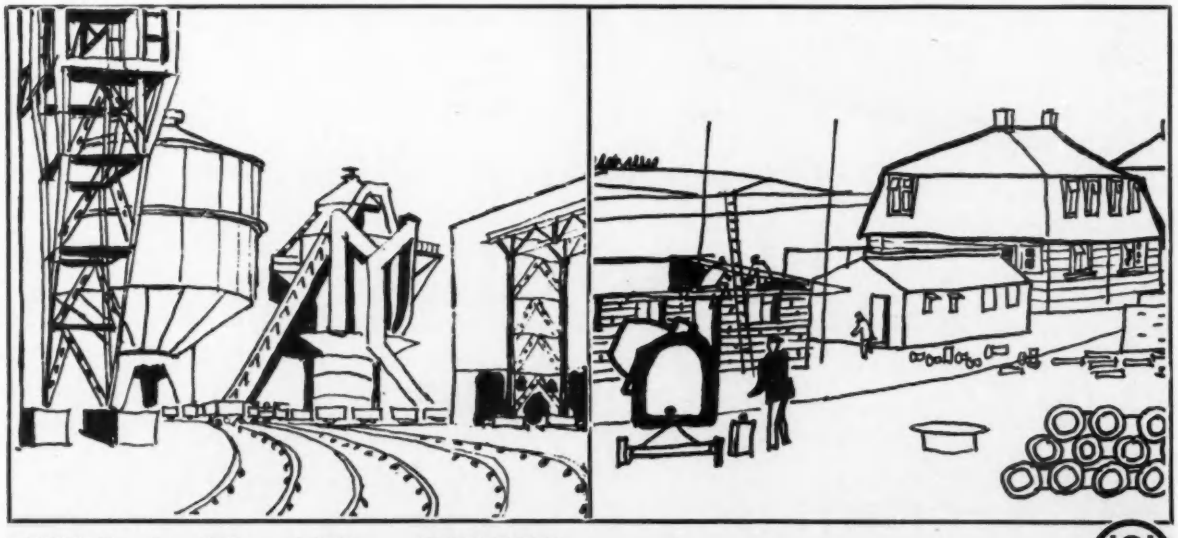

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INDEX TO 'JOURNAL' ADVERTISERS

A — PAGE

C.E Machinery, Ltd. ... ...
bbot, Birks & Co., Ltd. ... ...
ene Wringers, Ltd. ... ...
erog n Co., Ltd. ... ...
erog aph Co., Ltd. ... ...
lder & Mackay, Ltd. 433
lexa der Controls, Ltd. ... ...
llan Taylor (Engineers), Ltd. ... ...
mal, Ltd. ... ...
scot Gas Water Heaters, Ltd. ... ...
scot Gas Water Heaters, Ltd. (F. A. Nest) Cover IV
shmore, Benson, Pease & Co. .. ..
spinall's (Paints), Ltd. ... ...
ssociated Lead Manufacturers, Ltd. ... ...
ssociated Lead Manufacturers, Ltd. (Rustodian) 428
tlas Preservative Co., Ltd. 421
udley Engineering Co., Ltd. 438
utocontrol Boilers, Ltd. ... ...
utomatic Telephone & Electric Co., Ltd. ...
utomotive Products, Ltd. ... ...

B

le & Church, Ltd. 493
alfour, Henry, & Co., Ltd. 432
egnco Meters, Ltd. ... ...
enham & Sons, Ltd. ... ...
lakeley Firth, Sons & Co., Ltd. 418
olton's Superheater & Pipe Works Ltd. ... 435
oth, John, & Sons (Bolton), Ltd. ... ...
ratt Colbran, Ltd. ... ...
ray, George, & Co., Ltd. ... ...
ray, W. E., & Co., Ltd. ... ...
ristols Instrument Co., Ltd. ... ...
ritish Flint & Cerium Manufacturers, Ltd. ...
ritish Gas Purifying Materials Co., ...
ritish Oxygen Co., Ltd. ... ...
ritish Paints, Ltd. ... ...
ritish Rototherm Co., Ltd. 490
ritish Thermostat Co., Ltd. ... ...
ritish Thomson Houston, Ltd. 463
ritish Vacuum Cleaner & Engineering Co., Ltd. 422
roadbent, Thomas, & Sons, Ltd. ... ...
rockhouse Heater Co., Ltd. ... ...
room & Wade, Ltd. ... ...
rown, J., & Co., Ltd. ... ...
rugden, Thos., & Co. ... ...

C

ambridge Instrument Co., Ltd. ... ...
annon (G. A.), Ltd. ... ...
ascade Water Coolers, Ltd. ... ...
ementation Co., Ltd. ... ... Cover II
inema-Television, Ltd. ... ...
lapham Bros., Ltd. ... ...
layton, Son & Co., Ltd. ... ...
lifford Engineering Co., Ltd. ... ...
ochrane (Middlesbro') Foundry, Ltd. ... ...
obben, George, Sons & Co., Ltd. 437
oncrete Proofing Co., Ltd. 490
onsolidated Pneumatic Tool Co., Ltd. ... ...
onsett Iron Co., Ltd. ... ...
orane, Ltd. 440
orne & Taylor, Ltd. 462
rosby & Co., Ltd. ... ...
rossley Bros. ... ...
rowley Russell, & Co., Ltd. 441
urtis, A. L., & Co. ... ...
utler, Samuel, & Sons, Ltd. ... ...

D

avey, Paxman & Co., Ltd. 437
e la Rue, Thomas, & Co., Ltd. (Gas Group) ...
empster, R. & J., Ltd. ... ...
empster, Robert, & Sons, Ltd. ... ...
enison & Son, Ltd. ... ...
erbyshire Silica Firebrick Co., Ltd. ... ...
iaphragm & General Leather Co., Ltd. ...
ick, R. & J., Ltd. ... ...
onkin (The Bryan) Co., Ltd. ... ... Cover II
ouglas, Wm., & Sons, Ltd. ... ...
rakes, Ltd. ... ...
resser Manufactures (England), Ltd. 492
rew, H. B., Ltd. ... ...
unlop & Ranken, Ltd. ... ...
unlop Rubber Co., Ltd. (Gen. Rubber Goods Division) ... ...

E

B. Refractory Cement Co., Ltd. ... ...
gar, William, & Son, Ltd. 439
control, Ltd. ... ...
ectroflo Meters Co., Ltd. ... ...
ectrolux, Ltd. 445
liott Bros. (London), Ltd. ... ...
ther, Ltd. ... ...
vart Chainbelt Co., Ltd. ... ...
xpanded Metal Co., Ltd. 431

F

isher & Ludlow, Ltd. ... ...
ave, S., & Co., Ltd. 478
ewler, John, & Co. (Leeds), Ltd. 422
ull Compressed Pile Co., Ltd. ... ...
ullin Furnace Co., Ltd. ... ...
y's Metal Foundries, Ltd. 491
yfe & Co., Ltd. 446

G — PAGE

Gas Purification & Chemical, Ltd. 493
General Descaling Co., Ltd. ... ...
General Electric Co., Ltd. ... ...
General Gas Appliances, Ltd. ... ...
Gibbons Bros., Ltd. ... ...
Glover, George, & Co., Ltd. ... ...
Glover, Thomas, & Co., Ltd. 450
Goodall Clayton & Co., Ltd. ... ...
Goodyear Mechanical Goods ... ...
Graphite Products, Ltd. ... ...
Green & Boulding, Ltd. ... ...

H

Hamilton, A. H., & Co., Ltd. 496
Hardman & Holden, Ltd. ... ...
Harris & Pearson, Ltd. ... ...
Harrisons (London), Ltd. ... ...
Harvey, G. A., & Co. (London), Ltd. ... ...
Hattersley & Davidson ... ...
Hick Hargreaves & Co., Ltd. 434
Hilmor, Ltd. ... ...
Hills (West Bromwich), Ltd. ... ...
Holman, Michell & Co., Ltd. ... ...
Holmes, W. C., & Co., Ltd. 495
Hopkinsons, Ltd. ... ...
Horseley Bridge & Thomas Piggott, Ltd. ...
Horstmann Gear Co., Ltd. ... ...
Howden, James, & Co., Ltd. 427
Humphreys & Glasgow, Ltd. 448

I

Ideal Boilers & Radiators, Ltd. ... ...
I.C.I., Ltd. (Metals Division) 420
Ingham, John, & Sons, Ltd. ... ...

J

Jeavons, E. E., & Co., Ltd. ... ...
Jeavons Engineering Co. 426
Jenkins, W. J., & Co., Ltd. 425
Jobling, James A., & Co., Ltd. ... ...
Johnson, C. H., (Machinery), Ltd. ... ...

K

Keay, E. C & J., Ltd. ... ...
Keith Blackman, Ltd. 496
Kent, Geo., Ltd. ... ...
Kings Patent Agency, Ltd. 494
King, Walter, Ltd. 434, 493
Kirk & Co. (Tubes), Ltd. ... ...
Kirkham Hulett & Chandler, Ltd. ... ...

L

LaFarge Aluminous Cement Co., Ltd. 443
Laidlaw, R., & Son (Edin.), Ltd. 426
Lamont, James H., & Co., Ltd. ... ...
Lanarkshire Bolt & Rivet Co., Ltd. ... ...
Lancashire Dynamo & Crypto, Ltd. 429
Le Bas Tube Co., Ltd. ... ...
Leeds Fireclay Co., Ltd. ... ...
Lionweld, Ltd. ... ...
Lind, Peter, Ltd. ... ...

M

Macpherson, Donald, & Co. Ltd. ... ...
Magnetic Valve Co., Ltd. ... ...
Main, R. & A., Ltd. 484, 485
Measurements, Ltd. ... ...
Meltham Silica Fire Brick Co., Ltd. ... ...
Meters, Ltd. ... ...
Metropolitan Leather Co., Ltd. 450
Metropolitan Vickers Electrical Co., Ltd. ...
Milnes Meters, Ltd. 418
Mint, Birmingham, Ltd. ... ...
Mitcham Smelters, Ltd. ... ...
Mitchell Engineering, Ltd. ... ...
Mitchell, H., & Co. ... ...
Moler Products, Ltd. ... ...
Monitor Engineering & Oil Appliances, Ltd. ... 492
Monk, A., & Co., Ltd. 464
Mucklow Bros., Ltd. ... ...

N

National Benzole Co., Ltd. ... ...
National Enamels, Ltd. ... ...
New Conveyor Co., Ltd. 442
Newton Chambers & Co., Ltd. ... Facing p. 457
Norwest Construction & Co., Ltd. 417
Nu-Swift, Ltd. 493

O

Oxley Engineering Co., Ltd. ... ...

P

Parkinson & Cowan (Gas Meters), Ltd. 450
Parkinson Stove Co., Ltd. ... ...
Pass, E., & Co., Ltd. ... ...
Peckett & Sons, Ltd. ... ...
Peebles & Co., Ltd. 489
Perl Controls, Ltd. ... ...
Plenty & Son, Ltd. ... ...
Power-Gas Corporation, Ltd. ... ...
Pratt Engineering Co ... ...
Press, William, & Son, Ltd. ... ...
Pulsometer Engineering Co., Ltd. ... ...

R — PAGE

Radiant Heating, Ltd. ... ...
Radiation, Ltd. 476, 477
Rawlplug Co., Ltd. ... ...
Reavell & Co., Ltd. 430
Remington Rand, Ltd. ... ...
Richmond Welding Co. ... ...
Ride & Bell, Ltd. ... ...
Riley, A. J., & Son, Ltd. ... ...
Roberts, R. E., & Sons, Ltd. 434
Robinson, J. H., & Co. (Liverpool), Ltd. ...
Rook Bros., Ltd. ... ...
Royston, Geo., & Sons, Ltd. ... ...
Russell Bros. (Walsall), Ltd. 490
Russell, R., & Sons, Ltd. 496

S

Salter, T. E., Ltd. ... ...
Senior Economisers, Ltd. ... ...
Shaw & McInnes Ltd. 430
Shelton Iron, Steel & Coal Co., Ltd. ... ...
Siebe Gorman & Co., Ltd. ... ...
Siemens-Schuckert (Great Britain), Ltd. ...
Sigma Instrument Co., Ltd. ... ...
Simon-Carves, Ltd. ... ... Supp. bet. pp. 456, 457
Simon, Richard, & Sons, Ltd. ... ...
Sisson, W., & Co., Ltd. ... ...
Smith Meters, Ltd. ... Supp. bet. pp. 456, 457
Smith, Thos., & Sons (Rodley), Ltd. ... ...
Spencer Bonecourt, Ltd. ... ...
Sperryn & Co., Ltd. ... ...
Stanton Ironworks Co., Ltd. ... ...
Staveley Iron & Chemical Co., Ltd. ... ...
Steels Eng. Products, Ltd. ... ...
Stein, John G., & Co., Ltd. ... ...
Stewart & Gray, Ltd. ... ...
Stewarts & Lloyds, Ltd. ... ...
Stoves, Ltd. ... ...
Strachan & Henshaw, Ltd. ... ...
Stringer Bros. 494
Sugg, Wm., & Co., Ltd. 436
Summerson, Thos., & Sons, Ltd. ... ...
Sutcliffe Speakman & Co., Ltd. ... ...
Sutherland, A. G., Ltd. ... ...

T

T & T Works, Ltd. ... ...
Tangyes, Ltd. ... ...
Thermal Syndicate, Ltd. ... ...
Thomas & Bishop, Ltd. ... ...
Thompson, John, Conveyor Co. ... ...
Thorp, Thomas, & Co., Ltd. ... ...
Tucker, Eyelet, Geo., Co., Ltd. ... ...
Tully Engineering Co., Ltd. ... ...
Turners Asbestos Cement Co., Ltd. ... ...

U

Underpressure Engineering Co., Ltd. ... ...
United Kingdom Construction & Engineering Co., Ltd. 419

V

Visco Engineering Co., Ltd. ... ...
Vulcan Stove Co., Ltd. ... ...

W

Wakelin, F. H., Ltd. ... ...
Walker, C. & W., Ltd. ... ...
Walker, Crosweller & Co., Ltd. ... ...
Walker, Wm., & Sons (Hanley), Ltd. ... ...
Waller, George, & Sons, Ltd. ... ...
Ward, Thos. W., Ltd. 424
Weir, G. & J., Ltd. ... ...
Wellington Tube Works, Ltd. ... ...
Wellman Smith Owen Engineering Corpn., Ltd. 444
West's Gas Improvement Co., Ltd. Cover III
West's Gas Improvement Co., Ltd. (C.O.L. Division) ... ...
West Hunwick Silica & Firebrick Co., Ltd. ...
West's Piling & Construction Co. ... ...
Westwood & Wrights, Ltd. ... ...
Whessoe, Ltd. ... ...Cover I, 461
Whitlock Bros., Ltd. 449
Whittaker Hall & Co. (1929), Ltd. ... ...
Wilkes, A. H., & Co., Ltd. ... ...
Willey & Co., Ltd. 423
Williams, John E., Ltd. ... ...
Williamson Cliff, Ltd. ... ...
Wilson, George, Gas Meters, Ltd. ... ...
Winn & Coales, Ltd. ... ...
Woodall-Duckham Construction Co., Ltd. facing p. 456
Wood, Hugh, & Co., Ltd. ... ...

Y

Yorkshire Copper Works, Ltd. ... ...

Agency ... ...
Appointments Vacant 493, 494
Appointment Wanted ... ...
Contracts Open 494
Educational ... ...
Miscellaneous ... ...
Patents 494
Plant for Sale ... ...
Plant Etc. For Sale & Wanted 494
Publications ... ...
Repair Work... ... ...

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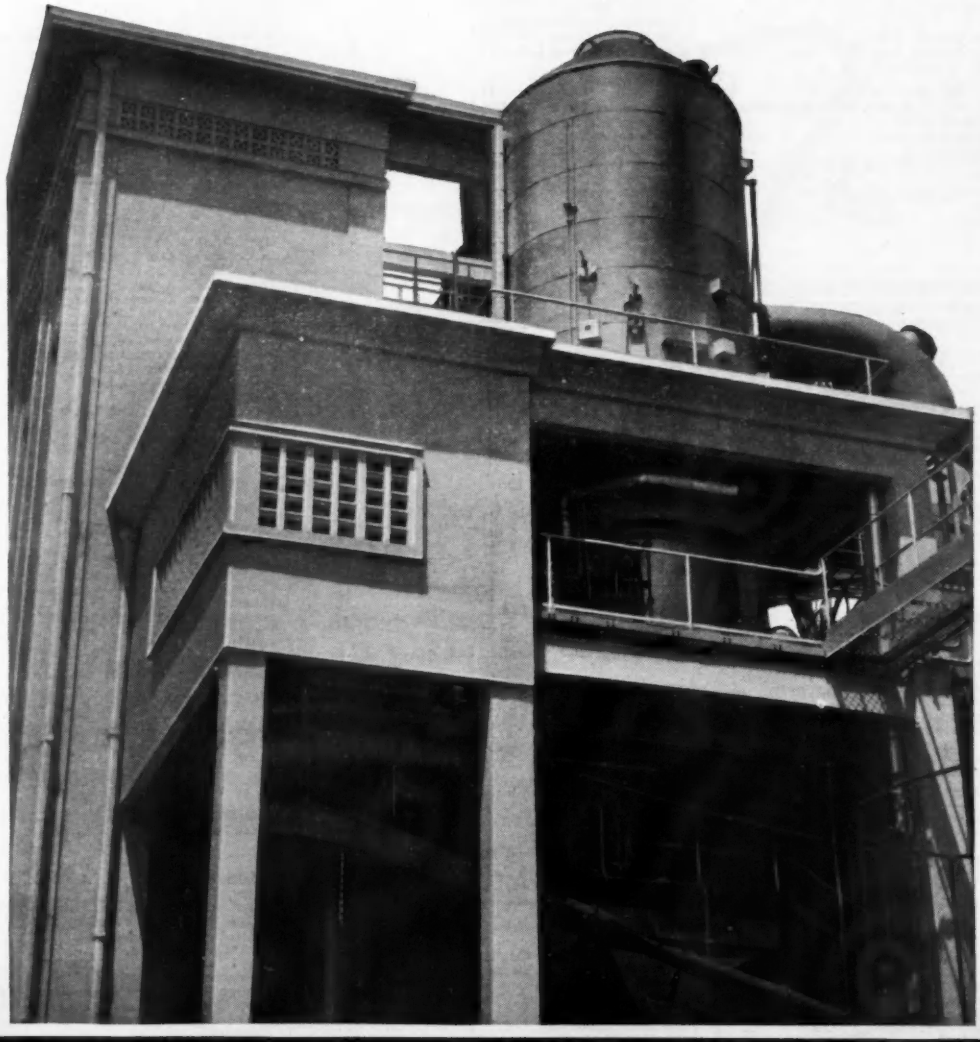

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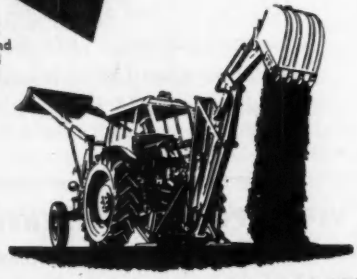

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Managing Director: Clifford A. King

Editor: Trevor G. Williams, A.M.I.Mech.E., Assoc.Inst.Gas E., M.Inst.F.
Deputy Editor: Arthur C. Cross

11, BOLT COURT, FLEET ST., LONDON, E.C.4.
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CONTENTS

EDITORIAL COMMENT

Second Thoughts on the Reports 451
Fishburn 452
Two Sales Bogeys 452

SPECIAL ARTICLE

Fishburn Coking Plant 457
Alternative Gases in France 473

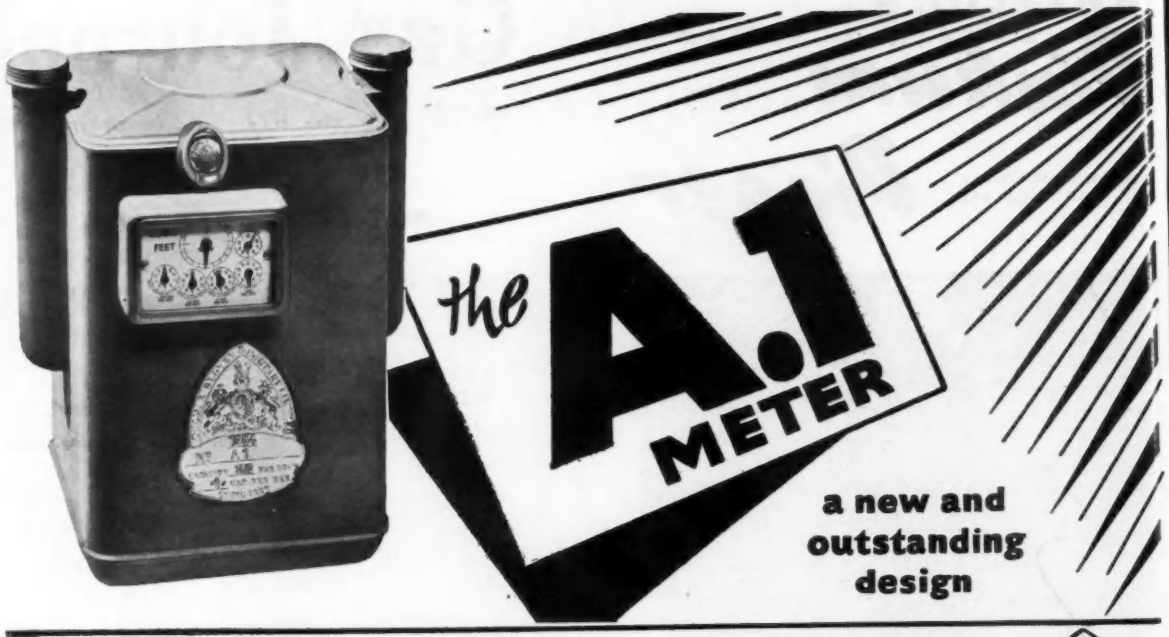
NEWS OF CURRENT EVENTS

Personal 453
Obituary 453
Diary 453
Christmas Lecture for Young People 453
Judge Criticises New Cleaning Plant 474
North Eastern Staff Conference Reception and Dance 474
Permanent Engineering Exhibition Centre 475
Review of Harrogate Discussion Panels—North Eastern Staff Conference 479
High Safety Factor Gas Heater 482
Gas and Electricity Link-up 483
A Hereford Protest 483
Gas at Trade Fair 483
East Lancashire Pipeline 483
Operation Rescue 486
Fifty Years of Building Education 486
Women's Gas Federation at Urmston 486
Manchester Juniors at Stretford 486
Trade News 487

TECHNICAL RECORD

Firedamp Reforming. By J. G. Pope and B. Richardson. Concluded from last week's 'Journal' ... 454
Tingley Liquor Effluent Plant. By P. C. Egan 469

PUBLISHERS' NOTICE, SEE P. 493



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Gas Journal

VOLUME 280 . No. 4772. NOVEMBER 17, 1954. 106th YEAR

Second Thoughts on the Reports

ON Tuesday, November 9, the House of Commons debated the Annual Reports and Statements of Accounts of the gas and electricity industries for no less than six hours, during the course of which time a number of very interesting points were made by members on both sides. In moving that the Reports and Statements be noted, the Minister of Fuel and Power, Mr. Geoffrey Lloyd, spoke of the substantial increase in the consumption of gas which has taken place this year as a result of increased industrial production. As he put it 'In the first half of this year industrial consumption of gas has increased by 8% overall and some boards have had increases in the industrial areas ranging from 10 to 15%.' There was no doubt in the Minister's mind that these encouraging results were related to the record levels of industrial activity which are a feature of the present time; he also thought that there is a new atmosphere of hope and confidence in the country and a feeling that there is now an opportunity to make real progress. Possibly one of the most significant remarks made by the Minister was his expression of the Government's determination to encourage the gas and electrical industries to compete with each other and with the oil industry as actively as possible. Mr. Lloyd said . . . 'this is a natural corrective to the disadvantages of monopoly and we should make full use of it. These industries, moreover, are historically competitive and we should take full advantage of that fact.' So we know where we stand! For the time being, at least, there will be no attempt by Parliament to lay down which type of fuel should be used for any particular purpose. The field is wide open to all comers and gas must concentrate its forces to continue the fight with electricity and oil on all fronts simultaneously. Now that full freedom of promotional advertising has been restored it is 'every industry for itself and the Devil take the hindmost.'

All things considered, the Minister appeared to be very pleased with the way things were going with the gas industry and he described at some length the various projects which were in hand for using inferior and cheaper coals, for making gas from oil and for seeking natural gas. Initiative and enterprise such as lay behind these ideas were much to be encouraged. In this the gas industry, in common with other nationalised industries, is in a difficult position compared with private companies, for not only does it have a statutory responsibility to Parliament on the one hand, but it is also subject to checks by consumers' councils on the other. The Minister said: 'All this is a necessary part of the system of nationalisation and of public accountability, and I am not objecting to it, but are we not asking rather a lot of these men (members of boards) when we expect them, in these circumstances, to be enterprising and venturesome? Is there not a tremendous danger that instead of looking ahead they will be looking over their shoulder?'

This is what one might call a very pertinent question. Members of gas boards are appointed by the Minister for a period not exceeding five years and during this time their actions are closely watched. Not unnaturally they think twice, or more than twice, before committing themselves to a line of action which might be termed 'venturesome.'

In view of the numerous accountabilities with which they are involved and the possibility that someone, somewhere along the line, will throw cold water on their schemes, it would not be surprising if, rather than risk a rebuff, they should tend to play for safety. This also applies, of course, in lesser degree, to all grades of staff in the industry, but it is the man at the top who is in the spotlight of publicity, and has to watch his step so carefully. Despite these potential brakes to enterprise the gas boards, as a whole, have shown remarkable ingenuity in overcoming the many serious difficulties which have faced them since the end of the war. The Minister said in the debate that he recognised that not every venture can be successful, and that there are bound to be mistakes. He affirmed, also, his determination to defend the boards when decisions taken were on 'sound and enterprising lines' and in this affirmation is the sanction which the industry requires to press ahead vigorously with its schemes for meeting the challenge of our times.

In a later part of his speech to the House, the Minister gave the gas industry a timely reminder of the immense possibilities for gas in industry, particularly in a wide variety of refined heat processes. He put the picture right in perspective when he said that 'at present coal is carrying the massive fuel load of the country, but that gas and electricity form, so to speak, the cutting edge by which industry advances its productivity.' The gas industry offers a refined fuel capable of accurate and automatic control, and there

can be no doubt that this is just what is required in many industrial processes. Here, in fact, is the 'opportunity of a lifetime' for the industry and it is to be hoped and expected that it will make the utmost use of it. Many new techniques have been developed since the war for the quicker and more efficient production of all types of commodity and it would seem that we are moving more and more towards automatic production methods in many cases. Obviously, where heat treatment is required, great savings can be made in production costs, if articles can be treated continuously as, for example, in gas-fired kilns or drying tunnels. According to Mr. Lloyd, the Austin factory of the British Motor Corporation at Birmingham has increased its consumption of gas per worker by 180% since 1939 and its output has trebled; these figures throw into high relief the valuable contribution which gas is making towards the increase of our industrial productivity. The industrial gas sections of the Gas Council and area boards are doing most valuable work in pressing the advantages of gas over other forms of fuel in these and many other instances and it is to the industry's advantage that their efforts should be encouraged and strengthened to the limit.

Space does not permit a fuller analysis of our legislators' deliberations, but one of the most significant features of this very interesting debate was the way in which the two main parties vied with each other in claiming credit for the advantages which have accrued to the country as a result of the nationalisation of the gas and electrical industries. Perhaps no other aspect of the discussion on the gas industry's position demonstrates more clearly the general satisfaction of Parliament with the way the industry is being run.

Fishburn

AN event of far-reaching importance to the carbonising industries took place when the fine new coking plant of the National Coal Board at Fishburn, Co. Durham, was recently put into commission. For the Coal Board the event was a memorable one since Fishburn is the first of the completely new coking plants to be entirely conceived, ordered, built, and put into operation since vesting day, and for the gas industry because a further and very substantial amount of coke-oven gas has been made available to the Northern Gas Board's North East Coast Grid. The prime reasons for the establishment of the new plant at the site chosen were, (1) the growing demand in the surrounding area of Tees-side for a good furnace coke, and (2) the existence at Fishburn colliery and nearby Thrislington colliery of supplies of suitable coking coals adequate to meet these demands. A further consideration was that the old coking plants at Fishburn and Thrislington—built in 1919 and 1915 respectively—were finding it more and more difficult to cope with the new level of requirements. Coal requirements for the new coking plant (1,000 tons per day) are obtained mainly from Fishburn colliery and washery which adjoin the coking plant while a certain amount is drawn from Thrislington.

In the circumstances it is clear that the Coal Board had a number of good reasons for investing in the Fishburn plant—in fact only one aspect of its operation was likely to cause concern at Carbonisation Headquarters and that was the disposal of surplus coke-oven gas produced. This was where the local gas board came into the picture. The Northern Gas Board, since its inception, has always taken a realistic view of the fact that its area of supply includes many of the most important coking plants of the National Coal Board, and it has recognised that the gas produced in the coking proces is, subject to slight modification on account of higher calorific value, eminently suitable for use as town gas. Furthermore, and particularly important, the Board has fully appreciated that as a side product of the process of furnace-coke production the surplus coke-oven gas should be cheaper than gas manufactured in a gasworks by any of the usual processes. As a very large proportion of the gas supplied to the Northern area is drawn from coking plants it is not surprising that the cost of gas there is the lowest in the country; it is also certain that the consumer would not wish it otherwise. From a national point of view, too, it is clearly beneficial for gas which formerly was wasted, to be put to good use; apart from this the saving in coal is considerable. This is, in fact, a classic example of co-operation between two great industries in the interests of the nation.

TWO SALES BOGEYS

One of the results of the merging of the Northern and Southern divisions of the South Western Gas Board has been the creation of one Area Sales Circle in place of the two which existed previously. Because of its central position Taunton has been chosen as a suitable venue, and it was here that the newly constituted Circle held its first meeting on October 20, with Mr. A. E. Marshall, District Manger, Plymouth, in the chair. Principal guest was Mr. Noel S. Smith, Area Development Manager who, having done his bit by explaining the function of the Circle and wishing the group every success, had to step into the breach later in the meeting to cope with a couple of awkward questions fired at Mr. W. T. Lane, of the Area Publicity Department, whose paper on 'Sales Education and Training' formed the main attraction of the meeting. As might be expected, these questions concerned matters of policy and we mention them here because, to our mind, they spotlight two of the main problems besetting the gas salesman today. The first dealt with so-called 'unfair competition' on the part of electricity boards in penalising occupiers of new houses who do not agree to use a certain number of electric appliances. The questioner instanced the charge, by the South Western Electricity Board, of £14 for a service if an electric cooker was not installed, and said that although competition could be an incentive, he regarded this as being contrary to the agreed principle of freedom of choice. As Mr. Smith said, this problem is not a local one, but he was unable to suggest any solution.

The other question concerned the suitability of the I.G.E. Course in Gas Salesmanship and Consumer Service. Earlier in the meeting the course had been criticised as being 'too technical,' and now a member asked (in effect) for some assurance that if he was prepared to obtain this qualification, he would obtain a suitable reward; and he enquired how his position on the acquisition of such a certificate would compare with that of similarly qualified employees in in other industries. In the circumstances one cannot blame Mr. Smith for hedging a bit over that one! This is a matter which has been raised at many sales meetings in recent months. We suggest that it might well have the attention of those responsible for ensuring that our sales staffs not only know where they are going, but are satisfied that their journey is necessary—and worth while, too.

Personal Notes

MR. HARRY DALEY, Mains and Services Foreman at Harlesden, retired on pension last month after more than half a century's service with the North Thames Gas Board. He has been Mains Foreman at Harlesden for the past 17 years, and has worked on the distribution side of the industry for the whole of his service, starting as a pot boy with the former Gas Light and Coke Company in 1904. The only interruption in his service was during the first world war when he was with the East Surrey Regiment in Salonika and Turkey. To mark his retirement, he was presented with an engraved clock, subscribed for by his colleagues, by Mr. L. C. S. Poulter, the Board's North Western Divisional Manager. Mrs. Daley, who accompanied her husband, was presented with a bouquet.

MR. NOEL GEE, M.C., has been appointed by the National Coal Board as Director of Public Relations in succession to SIR GUY NOTT-BOWER, who retired recently. Mr. Gee was educated at Harrow and Kent School, Connecticut. He became a student in Selfridges, London, at the age of 17, and later ran his own art agency in Fleet Street. In 1935, he joined Philip Gee, Ltd., who carried out the public relations work of the Mining Association of Great Britain and the Coal Utilisation Council. During the war he served in the Grenadier Guards and was later commissioned into the Royal Artillery. He commanded a battery in Italy, Greece, and the Middle East and was awarded the Military Cross. In 1946, Mr. Gee joined the public relations staff of the National Coal Board, and was later appointed Chief Press Officer.

MR. B. SAMUELS, M.I.MECH.E., has retired after 52 years with Babcock & Wilcox, Ltd., and more than half a century's active association with steam generation. After some years spent in the erecting department, he was transferred to the testing (now the service) department. He was appointed in charge of this work immediately after the 1914-18 war and the next 25 years was spent in building up the service department until it reached its present world-wide status. He has been associated for some quarter of a century with the British Standards Institution, and he has served on the General Council and is a member of the Engineering Divisional Council, the Council for Codes of Practice and the Solid Fuel Industry Committee. As a member of the Heat Engines Committee appointed by the Institution of Civil Engineers he took an active part in the preparation of the Boiler Test Code, which has been in use since 1927. The work has now been taken over by the B.S.I. and the preparation of a draft revised code by a joint committee of the B.S.I. and the Institution of Mechanical Engineers, of which he is chairman, is now nearing completion.

MR. WILLIAM WILBERFORCE, Fitting Superintendent to the Wolverhampton district of the West Midlands Gas Board, has completed his 50th year in the gas industry. At the end of this year he will retire. His place will be taken by MR. NORMAN SOUTHWELL, at present Mr. Wilberforce's assistant. Mr. Wilberforce entered the gas industry at Hull. Some ten years later he was Sales Manager with the Aldershot Gas, Water and District Lighting Company, and in 1921 he went to Wolverhampton as assistant fitting superintendent to the Wolverhampton Gas Company. He was appointed to his present position nearly 20 years ago.

COUNCILLOR JAMES HARKIN, J.P., who is employed in the North Eastern Gas Board's Batley showrooms in charge of the collection of accounts, had the honour of being presented to the Queen during the recent Royal Tour of Yorkshire. Mr. Harkin was first elected in 1941 and has a good record of public service in connection with his work on numerous committees. He is Chairman of the Watch and Parliamentary Committee and is a past Chairman of the Batley Waterworks Committee. Councillor Harkin is also a Governor of Batley Boys Grammar School.

MR. W. LAWSON HURDMAN has, state Rubery, Owen & Co., Ltd., joined the Senior Management of the Owen organisation as General Production Manager. Mr. Hurdman will operate from the head offices at Darlaston, South Staffordshire.

Obituary

MR. GEORGE REID, Works Engineer of R. & A. Main, Ltd., Falkirk, a passenger in a 1902 car taking part in Sunday's annual London to Brighton run for veteran cars, was killed in a collision at Bolney, Sussex. He was in the rear seat of a Panhard-Levassor driven by Mr. Roy K. N. Clarkson, of Halstead, Essex, and was seated with another passenger, both of whom were thrown out of the car. Mr. Reid died almost at once. Mr. Reid, who was 54, left home on Thursday for four days' holiday. He was not particularly interested in motor rallies but was a friend of Mr. Clarkson, member of a well-known Stirlingshire family.

Diary

Nov. 15-20.—PUBLIC WORKS AND MUNICIPAL SERVICES CONGRESS AND EXHIBITION. Olympia.

Nov. 18.—EASTERN SECTION, I.G.E.: 'Ten Years Experience with Automatically Operated Water Gas Plants', H. C. Dunbar, Works Engineer, St. Albans; 17, Grosvenor Crescent, 2.30 p.m.

Nov. 18.—LONDON JUNIORS: Afternoon visit to Ford Motor Co., Dagenham.

Nov. 20.—MANCHESTER JUNIORS: Joint visit to Bradford Road Works with Yorkshire Juniors. 'Concentrated Ammonicial Liquor Plant Operation,' D. Astbury.

Nov. 22-23.—INSTITUTION OF GAS ENGINEERS: Autumn Research Meeting, Church House, Westminster. (For detailed programme see 'JOURNAL' of Nov. 10, p. 388.)

Nov. 25.—MIDLAND JUNIORS: Visit to works of John Thompson, Ltd., Wolverhampton.

Nov. 25.—NORTH THAMES G.C.C.: Westminster City Hall, Charing Cross Road, W.C.2. 2.30 p.m.

Dec. 2.—SOUTH WESTERN G.C.C.: 34, Bridge Street, Taunton, 11 a.m.

Dec. 3.—LONDON JUNIORS: Annual Reception and Dance, Caxton Hall, St. James's Park, London, S.W.1. 6.45 p.m.

Dec. 4.—SCOTTISH JUNIORS (WESTERN DISTRICT): Joint Meeting with Eastern District, Heriot-Watt College, Edinburgh. 3 p.m.

Dec. 4.—WESTERN JUNIORS: Visit to Bath Gasworks: 'Human Relations in Industry—A Midsummer Night's Dream or As You Like It,' Dr. Duncan and K. E. Stringer.

Dec. 7.—SOUTH EASTERN G.C.C.: Caxton Hall, London, S.W.1. 11 a.m.

Dec. 7.—MIDLAND JUNIORS: 'Repairing a Bench of Vertical Retorts and the Extra Therm,' H. Kettlewell. Birmingham.

Christmas Lecture for Young People

The fourth Juvenile Lecture under the ægis of the Institution of Gas Engineers will be given in the Main Chemistry Lecture Hall of the Royal College of Science in Imperial Institute Road, on January 4, at 2.30 p.m. The lecturer will be Dr. A. E. Haffner, who has chosen as his subject 'The Production of Fuel Gases.' The lecture will be supported with practical demonstrations and experiments.

Dr. Haffner carried out research on high pressure gas reactions at the Imperial College before entering the gas industry where he worked first on research on gas making processes and later became responsible for gas production. He will be supported by a team of colleagues from the North Thames Gas Board.

Admission to the lecture will be free and tickets may be obtained from the Secretary of the Institution after December 1. The accommodation is limited to approximately 250. It is suggested that those who have not already done so, would find it an advantage to visit the newly opened Gas Gallery of the Science Museum either before or after the Christmas Lecture.

We conclude from last week's 'JOURNAL' the article describing work on firedamp reforming at the Whitehaven works of the Northern Gas Board.

FIREDAMP REFORMING*

By J. G. POPE, A.R.T.C., M.INST.GASE., M.INST.F., and B. RICHARDSON, F.R.I.C., M.INST.GASE.

The pilot reforming unit now in operation at Whitehaven is capable of dealing with up to 40,000 cu.ft. of firedamp per day or 800 cu.ft. per tube per hour with a temperature of from 950°C. to 980°C in the catalyst bed. Figures representing a typical 34 hours run under normal conditions of working are given below.

	cu.ft.
Firedamp used for reforming	37,580
Volume of reformed gas made	90,200
Make-up firedamp for blending with reformed gas	56,600
Firedamp used for heating furnace	33,230
Volume of blended gas (C.V. 475 B.Th.U.)	146,800

Efficiency of the Reforming Process

As regards heating efficiency, this is admittedly poor, and only some 47% of the total heat input to the furnace can at present be usefully utilised. The primary object, however, of the present unit is to gather information relating to the longevity of the heat-resisting alloy tubes, and for the time being the question of efficiency has been relegated to the background.

A rough assessment of the heat balance has nevertheless been drawn up using three simplifying assumptions. These are (1) that the reforming action is entirely $CH_4 + H_2O = CO + 3H_2$ and that no excess steam is present in the reformed gas, (2) that the reaction temperature is 984°C. (1,800°F.) and that the total heat in the reformed gases and in the combustion products are based on this temperature, (3) that the firedamp for heating is burnt with the theoretical quantity of air.

Obviously the temperature will be greater than 1,800°F. in the case of the combustion products, and in practice some excess air for combustion will be used, while there will be excess steam in the reformed gas. Consequently the calculations will represent a minimum value.

Under average conditions of working the heat balance of the reforming plant is given in the table below, which is set out in such a form as to show how a heat input of 100 therms is utilised or wasted.

Heat Balance, Firedamp Reforming Plant, Whitehaven

	Therms
(1) Heat input (100 therms) distributed as under	
Combustible heat in firedamp for reforming	51.4
Combustible heat in firedamp for heating	45.3
Total heat in steam to unit	3.3
(2) Heat output (100 therms) distributed as under	
Combustible heat in reformed gas	59.7
Sensible heat in reformed gas	5.6
Sensible and latent heat in combustion products	27.7
Radiation and other losses	7.0

The efficiency of the process is thus of the order of 59.7%, no less than 27.7% of the total heat supplied being lost in the hot combustion products leaving the furnace.

There is undoubtedly ample scope here for recovering a considerable portion of this waste heat, and calculations indicate that preheating of the combustion air and firedamp for reforming, by the waste combustion gases would effect the greatest savings. Furthermore, it should be possible by passing the hot reformed gases through a waste heat boiler to raise more than sufficient steam to render the unit self-supporting in this respect. It can be shown that on its present throughput the Whitehaven unit is capable of generating about 2,600 lb. of superheated steam per day from the reformed gases alone, and of this only some 1,700 to 1,800 lb. would be required for the catalytic decomposition of the firedamp.

By installing such devices it is probable that the efficiency of the process could be raised to about 75% concurrently with a substantial reduction in the volume of firedamp necessary to heat the furnace. Better utilisation of the heat might also be brought out by incorporating one or perhaps even two extra tubes in the furnace by which means the throughput could be almost doubled without incurring an appreciably greater fuel cosumption.

As it is, the overall efficiency of the Whitehaven plant—*i.e.*, the percentage of total potential heat inherent in the firedamp which is ultimately recovered in the firedamp-reformed gas blend—works out at about 76%, and the probability is that if waste heat recovery were practised to the fullest extent possible it would reach 85% or even higher. This may be compared with the 72% achieved by a modern carburetted water gas plant producing gas of 460 B.Th.U. calorific value, when provided with waste heat boilers and modified for operating the back-run process.

Extensive recuperation of heat, however, involves elaborating the layout and design of plant, and may be obtained at too great a price. In fact it will probably be found worth while sacrificing a portion of the heat recoverable at Whitehaven in order to preserve the simplicity of the reforming unit as a whole, and so render its supervision a task within the capabilities of an unskilled attendant. At the same time simplifications will generally help in keeping capital and maintenance charges down to the absolute minimum. The operation of the Whitehaven plant is certainly not automatic and requires a degree of skilled supervision in order that good results may be obtained over reasonably long periods. The factor which calls for most careful attention is that of steam supply, for unless this is kept adjusted within fairly close limits (40 to 47 lb. per 1,000 cu.ft. of firedamp) the efficiency of the reforming is apt to fall off very quickly indeed. This sensitivity appears to be aggravated if the steam is used in the saturated condition as is the case at Whitehaven, and the authors think that superheating would go far towards minimising or preventing this trouble. Given the necessary attention to the steam, a gas of remarkably constant calorific value and composition can be turned out.

Although the actual efficiency of reforming obtained with the catalyst now in use has been as high as 85%, the average figure taken out for the whole period since the inception of the new installation is 75%. This has been obtained in conjunction with tube temperatures of the order of 950°C. and a nominal contact time of a half second between the catalyst and firedamp-steam mixture. There appears to be no doubt that by conducting the reaction at or above 1,100°C., almost complete breakdown of the firedamp into carbon monoxide and hydrogen could be effected, but in view of the uncertainty of the behaviour of the alloy tubes at temperatures in excess of 1,000°C., and also in order to keep down the fuel consumption, it was decided not to exceed a figure of 950°C.-970°C., even if this meant a reduction in the proportion of methane converted.

Present Position and Future Prospects

The work has shown that firedamp reforming by means of a catalyst is a feasible proposition, and may be performed in a comparatively simple type of plant. So far the thermal efficiency leaves much to be desired, but it is capable of being greatly improved by the adoption of a system of waste heat recovery which would permit of the installations becoming

* Abstracted from a paper to a joint meeting of the North of England Section of the Institution of Gas Engineers and the Northern Junior Gas Association, October 21, 1954.

elf-supporting as regards steam, and also allow considerable cope for preheating the air supply to the furnace burners.

One of the most important facts brought out by the Whitehaven experiments is that a mixture of firedamp and reformed gas can be subsituted successfully for normal town gas of the same calorific value. Furthermore, the gas possesses a high degree of purity. Naphthalene is entirely absent, together with all those unsaturated hydrocarbon bodies which tend to polymerise into gums, and, perhaps most important of all, the total sulphur content is less than 2 grains per 100 cu.ft. It thus approaches very nearly to that *ultima Thule* of all gas engineers—namely, a gas which when burnt in the consumers' appliances yields combustion products consisting solely of water vapour and carbon dioxide.

Firedamp of 63% purity consists of about one-third air and therefore contains about 6.5% of oxygen, so that when it is finally blended with reformed gas to give a mixture of 470 B.Th.U., the inerts will probably reach 22%, of which 2% is accounted for by oxygen. Oxygen to this extent in town supply is likely to bring about increased corrosion of service pipes and dry meters, especially if, as is the case at Whitehaven, the gas is sent out from the works saturated with water vapour.

The oxygen content of the gas thus fixes a lower limit to the quality of firedamp which can be dealt with on the gas-works by the methods described in the present paper, and in the opinion of the authors this limit has now almost been reached.

Regarding the financial aspect of the methane reforming process precise figures cannot, at the present stage, be furnished. At Whitehaven labour charges provide one of the heaviest items in the cost sheet, as one man must be available for supervision the whole time although his actual duties in connection with the plant are light and normally occupy only ten minutes or so each hour. Further, the process steam is generated externally in an inefficient boiler burning coke. Assessing the incoming firedamp at 4d. per therm, the present gross cost (including capital charges) of the reformed gas appears to work out at from 8d. to 8½d. per therm and that of the final mixture 6½d. per therm. This estimate may be compared with the figures quoted by Nicklin and Redman in their paper describing the 'Rochdale' process of continuous accelerated carbonisation, given to the Manchester and District Section of the Institution of Gas Engineers on March 12, 1954. These authors quote the following gross costs (including capital charges), expressed as pence per therm, of producing gas by various methods at current prices of material, and in plant of a nominal 4 mill. cu.ft. per day capacity: (a) Coal gas in continuous vertical retorts 10.03d., (b) carburetted water gas from gas oil 9.19d., (c) carburetted water gas from heavy oil 8.93d., (d) complete gasification with heavy oil 8.71d. (e) oil gas (catalytic) from gas oil 9.73d., (f) blue water gas 7.92d., (g) complete gasification (C.V. 330 B.Th.U.) 8.03d.

From these figures it will be gathered that blue water gas and (perhaps) gas from complete gasification plants are the only two of the processes cited which can yield as cheap a product as Whitehaven reformed gas.

It should, however, again be emphasised that the present unit was erected primarily for experimental purposes and has not been designed to turn out gas under the best economic conditions. It is confidently expected that a plant of, say, 1½ mill. cu.ft. daily capacity, provided with means for recovering waste heat, and fitted with a degree of automatic control, would reform firedamp containing from 65% to 70% of methane for a gross cost of under 6d. per therm, in which case the final mixture into the holder would be about 5d. per therm.

If the whole or even a large proportion of the needs of an area were to be met exclusively by mine gas, it would be necessary to provide adequate standby plant and also keep personnel for its operation, so that in the event of a breakdown at the colliery an alternative supply of gas would become available at the shortest possible notice. This problem could, no doubt, be partly solved by the inauguration of a grid system of mains linking together the Workington and Carlisle Divisions, the emergency plant being situated at the principal works connected to and feeding into it. This plant might well be one of the catalytic oil-cracking types such as the Segas or Onia Gegi, which are very suitable for meeting peak load demands, while the combustion characteristics of the gas they produce are similar to those of coal gas. In the Workington and Whitehaven areas a local gas grid is actually in being. It is supplied almost entirely by gas purchased from coke ovens plus the relatively small quantity of processed firedamp used in the Whitehaven district. If more firedamp were taken in here than could be consumed, the surplus would require to be pumped back into the grid and utilised elsewhere, which in present circumstances could only be Workington, an area whose needs are already largely met by existing coke oven gas contracts.

For the moment, therefore, pending the construction of a comprehensive gas grid embracing the whole of West Cumberland, it would appear that the largest volume of firedamp which can safely be handled is about 1 mill. cu.ft. per day.

DISCUSSION

Mr. **E. Crowther** (Chairman of the Northern Gas Board), who was unable to be present, wrote that the importance of the work was not to be judged by the scale of operations described, but lay rather in its having demonstrated that the desired results could be achieved with plant essentially simple, inexpensive and robust, by no means difficult of control. Moreover, it had been shown that the process could be successfully operated over a wide range of concentrations of methane in the firedamp received, whereas originally it was believed that any lower concentration than 75% would be quite unsuitable.

Mr. **M. Redman** (Deputy Production Engineer, North Western Gas Board) said it was important to consider the utilisation of the hydrocarbon gas in relation to the particular local circumstances. While it might be shown that, when the hydrocarbon gas was inexpensive, the cheapest diluent was that provided by reforming the gas itself, this involved loss of rich gas therms and such therms might be more valuable for enrichment if, in a particular locality, additional gas had still to be manufactured by other means. For example, if regular carburetting of water gas was being practised in the locality, the greatest reduction in gas production costs would occur if the hydrocarbon gas was used for cold enrichment to replace oil. Account must be taken, however, of the cost of distributing this rich gas over a wider area and of final gas composition at each point of distribution to consumers. It followed from these considerations that the thermal proportion of rich gas available to the gas demand in the locality was also a vital factor in the analysis.

In the Whitehaven case, where no gas manufacture was apparently carried out, where large supplies of coke oven gas were available from the grid, and where no gasification plant was installed, the merits of reforming were obviously considerable.

The problem of cessation of supply of the firedamp and the provision of standby means of gas supply might materially influence the economics of hydrocarbon reforming and the authors referred to the provision of a plant of the Onia-Gegi or Segas type to meet the eventuality, these providing gas of similar composition from oil. Since the former plant was already known to be capable of reforming gases of high methane content, it would appear desirable to utilise that type of plant rather than tube reforming, since the latter was not easily adaptable to standby oil gasification. Whichever plant was used the cost of the standby equipment must be appreciable and might constitute a barrier to the increasing use of hydrocarbon gas where the price per therm delivered to the reformer was not sufficiently low.

Not least among the valuable information obtained from the authors researches was the apparent resistance of the catalyst to poisoning by sulphur compounds, a factor which would appear to have received inadequate attention in the past. Although many supplies of naturally occurring gases had low sulphur contents there was no guarantee that that could be the case with any new supplies and the advantage of having a catalyst which would preserve its activity to gases containing quite high proportions of sulphur compounds was considerable. That was an added attraction in favour of the Onia-Gegi plant, which was capable of gasifying heavy oil with sulphur contents of 3 to 4% without significant reduction in catalyst activity.

The enterprise of the Northern Gas Board in developing its own equipment to reform the Whitehaven firedamp was to be highly commended and the initiative and independent approach to the problem which the authors had shown was deserving of high praise. Initiative and enterprise were two qualities which the industry needed now more than at any time in its existence and it was clear for all to see that neither quality had been lacking here.

Mr. **B. Richardson**, replying to Mr. Redman, said the fact that there existed no water gas plant unit at Whitehaven, and that coke would be required to be brought into the works, was mainly instrumental in the decision to try catalytic reforming. Water gas contained hydrogen sulphide as well as other sulphur compounds so that if it were employed as a diluent for firedamp, oxide purification would be necessary. By reforming firedamp that need was obviated, for after cooling to atmospheric temperature, the gas could be used without further treatment.

The possibility of cessation of supply of firedamp and the necessity for providing standby plant was certainly a handicap to extensive adoption of the practice in the Whitehaven area as matters stood at present. The firedamp was drawn from one pit only, but if it were possible to link up a group of mines with a collecting grid the chance of complete failure would be much less.

Mr. **K. W. Francombe** (Whessoe, Ltd.) stated that the successful operation of the project led one to consider where methane could be found. He understood that in many pits firedamp was not available in sufficient quantities for economical projects to be generally established. The Chairman of the Northern Gas Board had mentioned the importation of liquid methane. Was it possible to collect and reform the methane from inland sewage farms? Also, were other hydrocarbon gases available which could be reformed instead of methane?

Mr. **Richardson** replied that the possibility of collecting and utilising methane from inland sewage farms was a feasible proposition. By subjecting the solid sediment in the settling tanks to a process of bacterial fermentation a gas is obtained consisting of 73-75% methane, 18-25% carbon dioxide, small amounts of ammonia and hydrogen, and from 1 to 1½% of sulphuretted hydrogen. The calorific value is about 750 B.Th.U. per cu.ft. and the specific gravity 0.75. About 8 cu.ft. could be produced from 1 cu.ft. of sediment. To give some idea of the quantity of such gas obtainable from the sewage of a large city it might be mentioned that in 1941 at Stuttgart about 70 mill. cu.ft. were produced and at Munich in 1938 as much as 100 mill. cu.ft.

Mr. **W. A. Lloyd-Dodd** (Industrial Manager, Tyneside Division, Northern Gas Board) said that while appreciating the achievement of developing a catalyst immune to poisoning by sulphur and the fact that experiments were continuing to obtain such a catalyst reactive at 700°C., the alternative approach, namely removal of sulphur from the firedamp, should also be investigated thoroughly in view of the pressing advantages of operation at a lower temperature than at present. At present an operating temperature of 950°C., involving a furnace temperature of 1,100°C. was required, whereas if sulphur was removed prior to reforming, catalysts could be employed giving 99% conversion with a shorter contact time at 700°C. The advantages of operation at 700°C. were obvious, and most important.

While sympathising with the desire of the authors for simplicity he could not agree that full heat recovery from the hot reformed gas and products of combustion to provide preheating of the firedamp for reforming and air for combustion, together with the production of the steam required in the process, would complicate the plant to anything like the same extent that they would reduce operating costs.

Mr. **Richardson** said Mr. Lloyd Dodd referred to the possibility of reforming at temperatures of 700°C., and obtaining a 99% efficiency of conversion. It should, however, be pointed out that all such results had been claimed with either pure methane or propane-butane mixtures. Firedamp consisting of 63% methane and 36% air, which was what they had to deal wiht at Whitehaven, was a somewhat different proposition, and it was probable that if one attempted to reform this at 700°C. very undesirable by-products such as formaldehyde would be produced. Moreover, if such a method were capable of general application one might expect to find the majority of reforming plants today operating at 700°C., whereas the temperatures most frequently quoted varied between 850°C. and 1,000°C. It was realised that the throughput of the existing unit at Whitehaven was limited, but that was because the steam and firedamp were supplied at a relatively low temperature and cooled down the catalyst at the inlet end of the reactor tubes. By carrying out preheating this trouble would no doubt disappear. With a tube only 18 ft. long it was still possible to reform 80% of the methane in the firedamp with a nominal time contact of less than half a second which it was claimed could be regarded as satisfactory.

The advantage of compressing the incoming gas to three atmospheres was that by so doing three times the volume could be passed through the tube for the same contact time, as would be possible when using atmospheric pressure. The question of waste heat recovery was an important one, and would be accorded serious consideration in any future plant of this type. Even so, it was worth while noting that with no recovery at all practised, the fuel cost was only about 1.2d. per therm of reformed gas-firedamp mixture put into the holder.

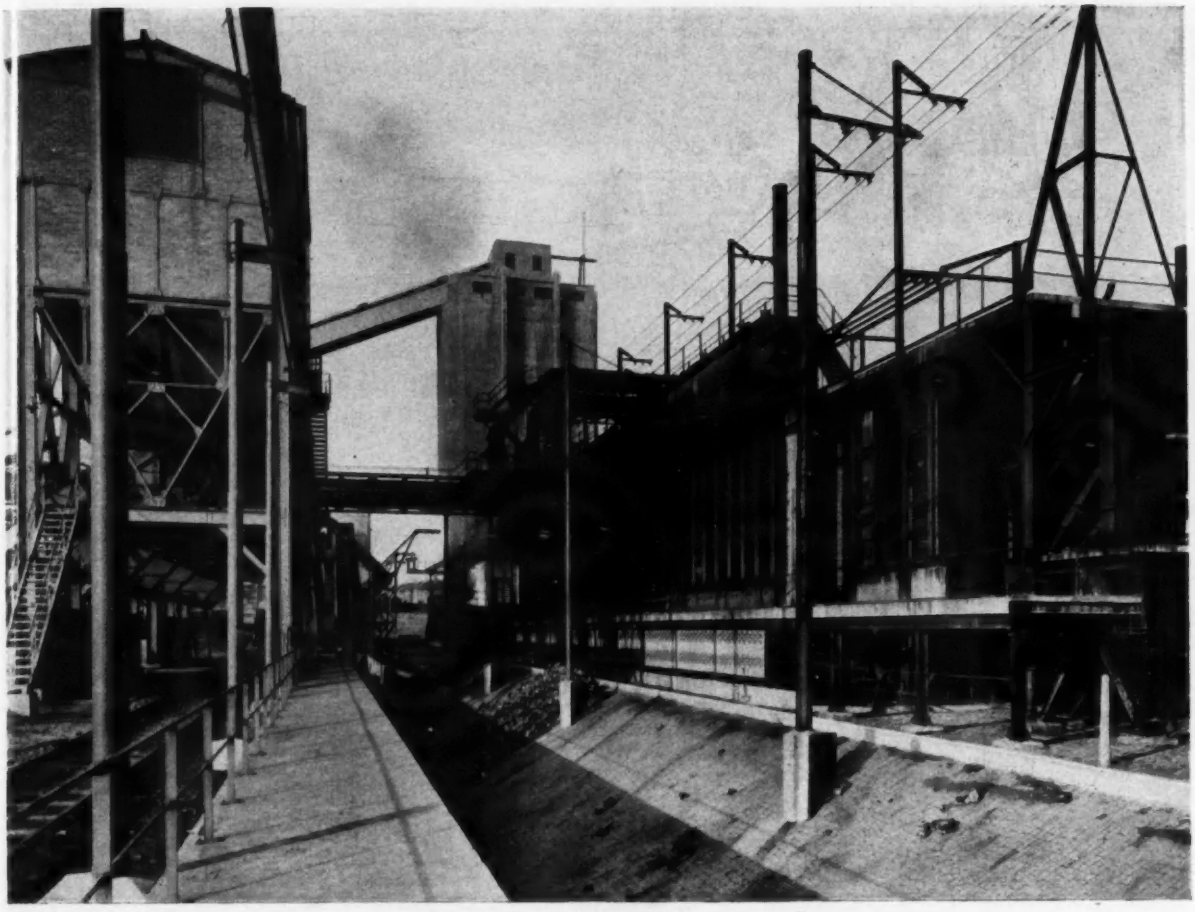
Dr. **John H. Jones** (National Coal Board) stated that the primary object of the scheme from the point of view of the National Coal Board at the Haig pit was to reduce the mining risk associated with firedamp, and accordingly to remove the maximum practical quantity of firedamp in order to achieve safety. There were practical limits to which the concentration of methane in the mixture could fall, because of the large volumes of air entrained in the later stages of extraction. He also pointed out the difficulties of endeavouring to guarantee quantity and quality. Although these had changed they had not done so quickly. At the beginning of the scheme relatively large amounts of firedamp had been available, some of which had come from old workings. He also stated that at present the Northern Gas Board was taking a fairly small percentage of the total output of firedamp, and the remainder was being consumed on works boilers where quality was not particularly important.

Mr. **R. Jones** (Newcastle) said he considered the furnace efficiency of 40% to be poor when compared with what could be achieved with full waste heat recovery, but considered the figure quite creditable for a furnace operating without waste heat recovery. He could not understand why it was considered that additional tubes could be operated in the existing furnace with only a small increase in fuel consumption. He presumed that the furnace had been designed to supply the heat necessary for the existing two tubes, and that if further tubes were used correspondingly greater amounts of heat would be required.

Mr. **D. J. Turner** (Wales Gas Board) said that his Board had an option on 600,000 cu.ft. per day of methane from Point of Ayr colliery, but they were considering approaching the problem from a different viewpoint and using blue water gas or an Onia Gegi plant for reforming. This plant could be used as a standby unit for cracking gas oil. In the case of his Board it was envisaged that the North Wales grid would have points where coke oven gas, I.V.C. gas or reformed gas could be taken in, and each or all used by consumers without difficulty. It had been estimated that in some cases between 2,000 cu.ft. and 5,000 cu.ft. of methane could be expected to be liberated from the mining of each ton of coal. If this were true then there would be sufficient methane available in the country to supply the needs of the gas industry.

Dr. **John H. Jones** said the volume being liberated at the Haig pit was approximately 1,066 cu.ft. per ton of coal. Over the whole of Britain the quantity varied between 0 and 5,000 cu.ft. per ton. There were 19 pits where methane drainage was being practised, and with the exception of Point of Ayr, the methane output of the whole 19 pits was only three times that of the Haig colliery. The liberation of methane at Point of Ayr was almost a freak, and could nearly be considered as a natural gas source.

AN EXTENSION to the Royal Technical College, Glasgow, has been approved on the east side of John Street, near the college. The new building, which will cost £260,000, will comprise an extension of the present boilerhouse and laboratories.



The W-D Becker Combination Underjet Coke Ovens in operation at the Fishburn Carbonisation Plant of the Durham Division of the National Coal Board.

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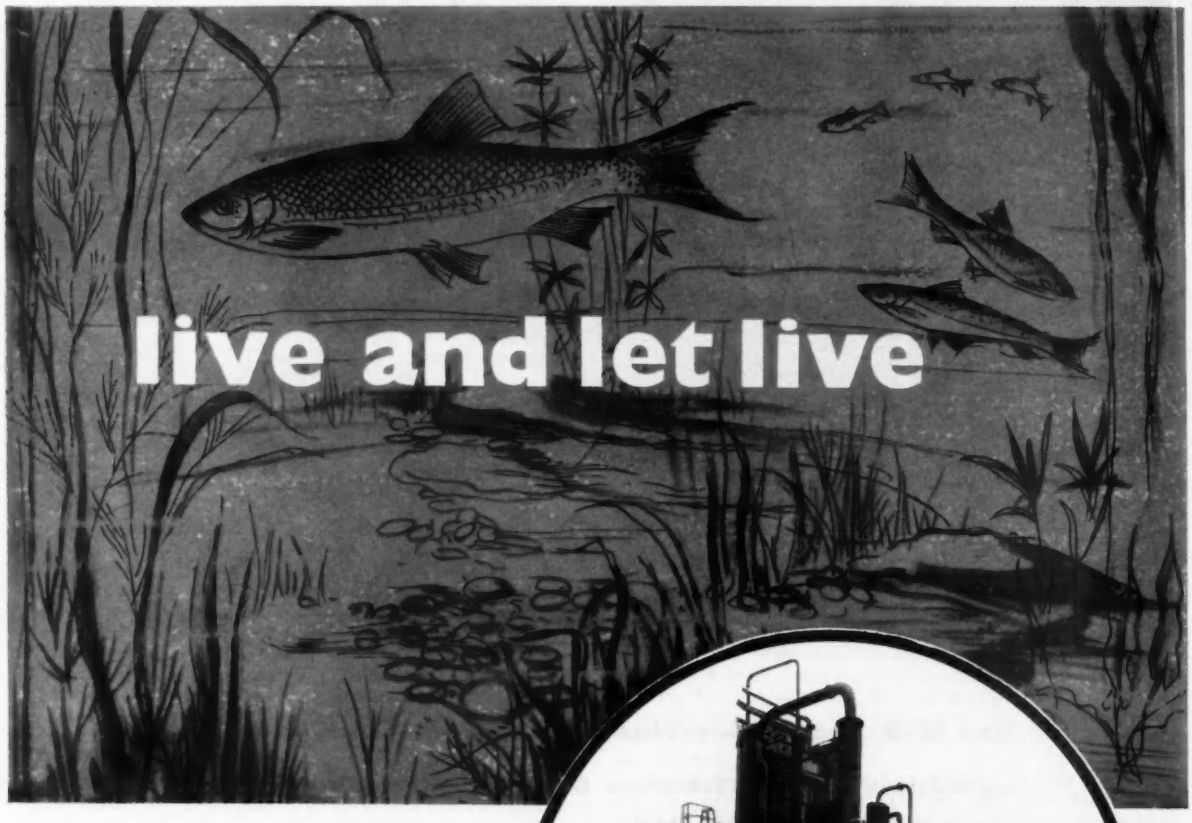

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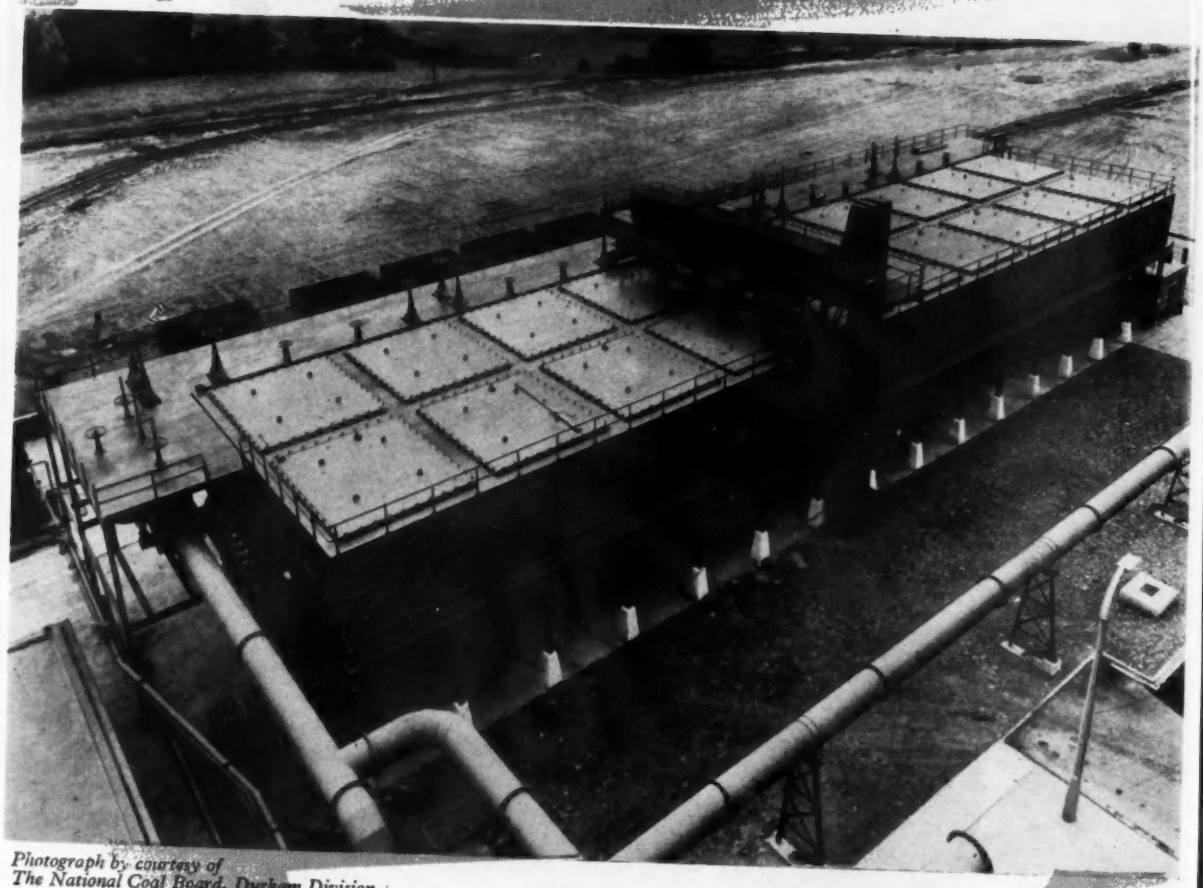

Photograph by courtesy of The National Coal Board, Durham Division.

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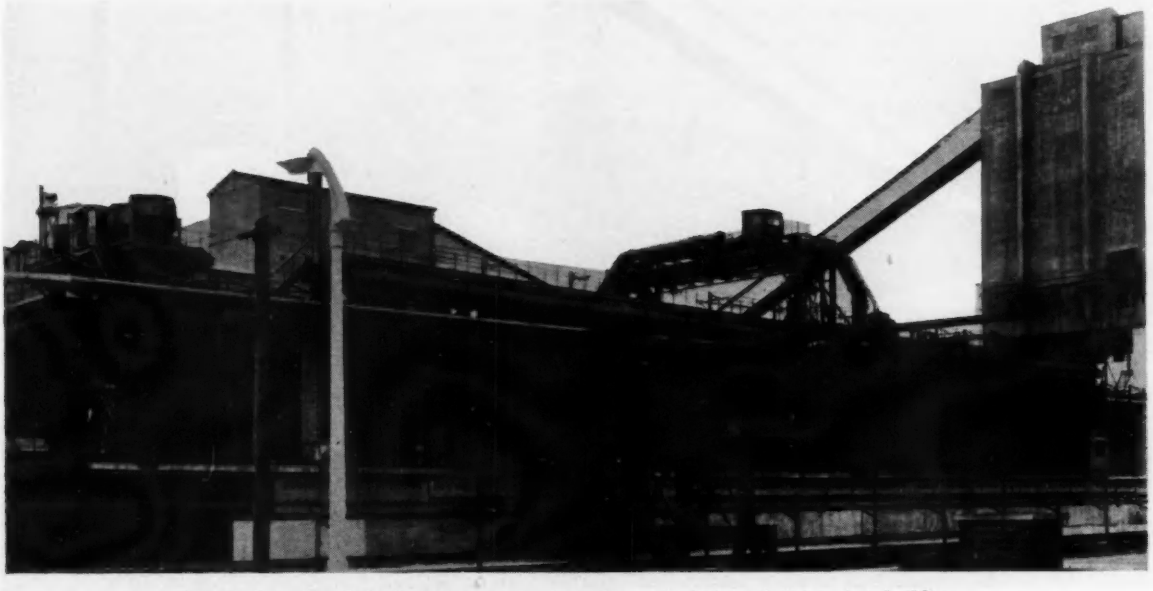


The pusher side of the batteries as seen from the roof of the administration building.

FISHBURN COKING PLANT

A description is given of the important new coke oven installation of the National Coal Board at Fishburn, Co. Durham, an installation which is supplying large quantities of gas to the Northern Gas Board.

THE National Coal Board have seventeen coking plants in the Durham Division which carbonise over 4 million tons of coal a year and produce nearly 3 million tons of coke including 750,000 tons of foundry coke. The Divisional coke-oven building programme is designed to provide for the replacement as necessary (either on the same or new sites) of such of the Board's coking plants which are, owing to age and design, difficult to maintain and operate efficiently. In deciding on the best location for the new plants, careful regard has had to be paid to the changing nature of the Durham coalfield and the re-organisation plans for the mines.

In some cases, it has been possible either to increase the capacity of the existing plants or to build larger batteries on the same sites, in other cases, new sites have had to be chosen. The Board's immediate construction programme up to 1958 consists of new coking plants at Fishburn, Lambton and Murton, each to carbonise initially 1,000 tons of coal per day and also includes doubling the Monkton plant, which will then be dealing with a total of 1,300 tons of coal daily.

Under an 'agreed scheme' relating to the carbonisation activities of the Northern Gas Board and the National Coal Board, both boards have planned to meet their respective obligations in regard to coke and gas supplies with a minimum expenditure of capital in the aggregate and will be able to ensure that neither coal nor gas will be wasted. The Fishburn plant is, therefore, the first of four new coke works which, together with existing ovens at Brancepeth and Stella Gill, will be able to supply 40 million cu.ft. of purified gas per day to the Gas Board's local grid system in addition to 20 million cu.ft. of unpurified gas available from the Norwood, Derwenthaugh and Trimdon coking plants.

The installation consists of 50 W-D Becker combination underjet ovens capable of carbonising 1,000 tons of wet coal per day; a coal handling, blending and crushing plant; a coke handling and screening plant; a by-product recovery plant of the semi-direct type; a crude benzole plant; a water cooling and recirculation system and extensive railway sidings. The main contractor for all the foregoing plant was the Woodall-Duckham Construction Co., Ltd., and a list of their sub-contractors is given at the end of this article.

Provision has been made in the design and layout of the plant for a future 100% extension and also for the addition of a benzole rectification plant.

Coal Handling and Blending

Coal for the plant is drawn, in the main, direct from the washery and screens of the nearby Fishburn Colliery although provision is made for the use of coal from other collieries.

A system of belt conveyors from the washery delivers coal of minus ½ in. size at the rate of 330 tons per hour to the range of twenty reinforced concrete blending and storage bunkers. The bunkers are arranged in two rows of ten and each has a capacity of 200 tons. The range has been designed for extension in the future when the total storage capacity will be increased from 4,000 tons to 5,600 tons.

At the bottom of each bunker there is a hoppered outlet provided with a rack and pinion operated door to control the discharge of coal on to the travelling belt feeders situated below. There are eight travelling feeders, four for each row of bunkers, and they run on tracks laid in the floor beneath the bunkers. Each feeder has an adjustable feed to its 42 in. belt which is electric-motor driven through variable speed gears and is capable of handling 80 tons of coal per hour.

The coal handling plant from the blending bunkers onwards has a capacity of 300 tons per hour. The oven's coal bunker is of reinforced concrete and has a total capacity of 3,000 tons of washed crushed coal. It is approximately 145 ft. high and there is a separate compartment of 600 tons which can be used as a test compartment if required. There are 20 discharge gates which are connected in rows of four per bay. The blending bunkers and oven's coal bunker were built by A. Monk and Co., Ltd.

Oven Charging

From the oven's bunker coal is charged to the ovens by means of the coal charging car, which is of the portal type with an elevated main frame. The car is electrically propelled and runs on rails on top of the battery. It has four steel hoppers

Fig. 1. View from bridge above batteries showing conveyors and screening stations.

having a total capacity of approximately 17 tons of coal. Each hopper is fitted with an electrically operated vibrating gear and an adjustable measuring device. At the bottom of each hopper there is a cast steel outlet piece fitted with a quadrant gate which can be individually operated by hand levers from the control cabin. Below each gate there is a mild steel telescopic dropping sleeve which can be raised or lowered by hand lever operation in the operator's cabin and can be operated independently of the quadrant gates. Hand levers are also provided so that the dropping sleeves can be raised individually from the battery top level. They are interlocked with the travelling gear so that the car cannot be driven with the sleeves down.

A weighbridge of 60 tons capacity is provided for weighing the coal in the car before charging and it is fitted with a dial indicator and recorder.

The Coke Ovens

The ovens are arranged in two separate batteries of 25 ovens each built in line with the coal storage bunker at one end and the stack at the opposite end. The ovens are of the W-D Becker combination underjet type each being 40 ft. 9½ in. long between the doors, 13 ft. high and having an average width of 18 in. The volumetric capacity of each oven is 735 cu.ft. and the batteries are designed to carbonise daily 1,000 tons of coal containing 9% moisture. The ovens are designed for heating either by coke-oven gas when the underjet system is employed or alternatively by producer gas when the producer gas mains are added in the future.

The fuel gas piping and the underjet firing controls are located in the spacious basement below the battery structure which is supported on reinforced concrete beams and columns. The pinion wall at each end of each battery is constructed of brick with a steel grillage and is supported independently of the concrete pad. The battery bracing consists of spring controlled rigid steel members the springs of which can be adjusted to a pre-determined pressure.

The waste gas flues are of reinforced concrete lined with firebrick and are built along each side of each battery to connect to the stack at the end of the battery. The stack is 225 ft. high and is firebrick lined for the first 70 ft. above the waste gas flue inlet.

The heating system consists of a series of vertical flues on each side of each oven connected by cross-over flues over the top of alternate ovens. Beneath each series of vertical flues and connected to them are two regenerators. Each regenerator is divided by a central division wall into two sections of half oven length. When coke oven gas is used as the heating medium the underjet system is employed and half of the regenerators (alternate fours in the length of the battery) are utilised to pre-heat the air.

The coke oven gas is fed from the fuel gas main through connections carrying the reversing and isolating valves to alternate pairs of cross header pipes in the basement beneath the battery structure. From the cross headers, of which there is one beneath each pair of regenerators, pipe connections lead the gas to the vertical ducts in the wall between the two regenerators. The gas passes up through the vertical ducts to the base of the vertical heating flues where it meets the preheated air and combustion commences. The contour of the flues from the regenerators up which the preheated air travels is such that the air and gas meet with a streamline effect and the burning gas is distributed throughout the length of each vertical flue and even heating of the ovens is obtained. Combustion takes place along the entire length of an oven wall simultaneously.

The battery control room is situated at bench level at the ovens' coal bunker end of the battery. The reversing machine,

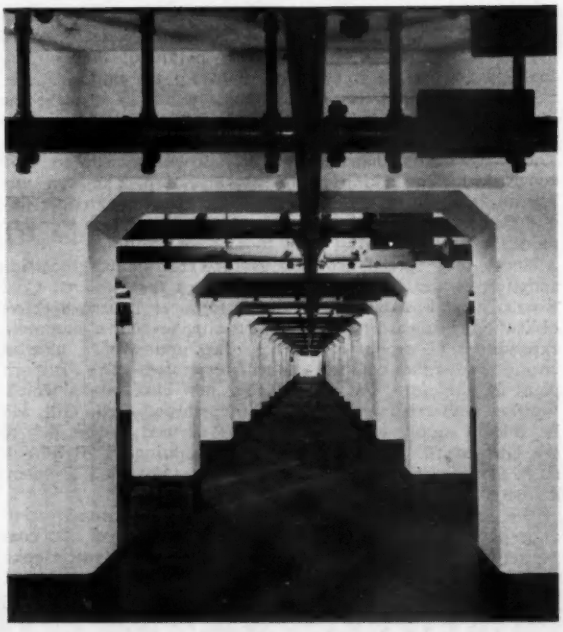


Fig. 2. Cellar beneath batteries, showing pipes feeding fuel gas to underjet heating system.

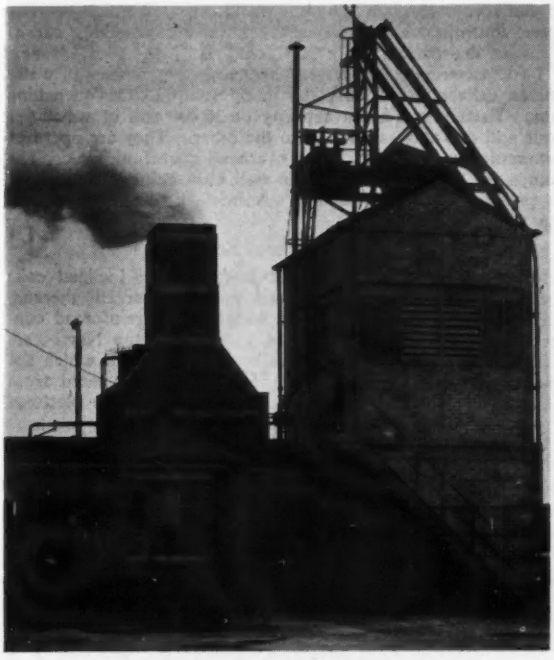


Fig. 3. Producer plant house with coke quenching tower in background.

which operates the fuel gas cocks and the air and waste valves, is placed in this room and is provided with totally enclosed gearing running in oil. Normally operated by an electric motor, the machine is also provided with a steam engine standby which can be used in case of a failure of power. The movements of the reversing machine are controlled by an electric clock which can be set to operate the machine at various time intervals. An emergency push-button control is provided. Should the clock fail to operate the reversing machine at the pre-determined time an alarm is automatically sounded. Also located in this room is the Reavell Askania regulator which automatically controls the pressure of the coke oven fuel gas.

Upon reversal of the valves, which is automatically controlled and occurs at 30 minute intervals, the coke oven fuel gas is fed through the alternative pairs of cross-header pipes and vertical ducts and the air passes up through the regenerators down which the waste gas had passed previously. The outstanding features of the heating system are the simplicity of the gas flow, the cross-over flues which carry the products of combustion over the top of the oven and the absence of leakage.

Producer Gas Plant

In view of the fact that the coke-oven gas has a higher calorific value than that of the town gas distributed in the area of the Northern Gas Board, it is necessary for a diluent gas to be added before the gas is passed from the coking plant to the mains. Provision has been made for such diluent gas to be added before the purifiers and the plant installed for the purpose of manufacturing the gas in a Gibbons-Heurtey H.W.J. 18 gas producer complete with cleaning plant, air fans, gas washing fans and automatic skip hoist. This producer uses as fuel either ¾ in. to 1½ in. or 1 in. to 2 in. coke nuts and is designed to manufacture up to 41,600 cu.ft. of gas per hour; the load on the producer varies, of course, with the quantity of gas taken by the gas board, but the plant has ample flexibility, allowing a wide range of outputs. Producer gas output and flow into the main gas stream is controlled by a Sigma Kent calorimeter-controller which automatically adjusts the output of the producer plant to give the required calorific value of the mixed gas. The producer itself is a fan blown, water jacketed, self vapourising unit, fitted with hand charge hopper, mechanical grate, air pressure regulator and air-blown poke holes. The producer gas plant is housed in a separate building, the exterior of which can be seen in Fig. 3.

Gas Collecting System

The crude gas leaves the ovens through ascension pipes at both the pusher side and the coke side and passes into the gas collecting mains which are also on both sides of the batteries. Two bridge pipes, one for each battery, span the batteries at their adjacent ends and connect the pusher side and coke side collecting mains. From the centre of each bridge pipe there is an offtake main and these two offtake mains are joined into a common suction main which spans the coke car track and terminates at the downcomer before the primary cooler. The provision of two offtake mains enables each battery to be operated individually.

Two ascension pipes are provided for each oven, and they consist of a refractory-lined mild steel stand pipe and cast-iron return bend with inspection hole and cast-iron cover. Each return bend is fitted with a spray for liquor flushing and with a steam connection for use during the coal charging operation.

The collecting mains have liquor sprays positioned at every alternate oven and each main is complete with a liquor-sealed bleeder. Four pitch traps are provided to serve the collecting mains. A structural steel bridge supports the bridge pipes over the batteries. Two gas pressure regulators are provided to maintain a constant pressure in the collecting mains. Each offtake main has a butterfly valve which is controlled by a regulator enclosed in a cabin on the bridge over the batteries.

Gas Cooling and Tar Extraction

The gas passes from the ovens to the primary coolers which are of the vertical tubular water-cooled type standing on an elevated reinforced concrete structure. There are three coolers, two of which are normally in operation with one as standby, and each cooler is provided with two seal pots to receive the condensed tar and ammoniacal liquor. The space beneath the coolers forms a washroom with showers, etc., for the by-product plant operatives.

From the primary coolers the gas is passed by the exhausters to the electro-detarrers. There are two detarrers of 9 ft. diameter and they are of the vertical tube suspended wire electrode type. Normally both are in operation, but in an emergency either is capable of handling the normal gas load without loss of efficiency. The detarrers are located on the roof of the building containing the two transformer rectifier sets for operating the detarrers.

Exhausters

Two turbine driven centrifugal gas exhausters of the axial inlet radial flow type are provided, each of which is capable of passing all the gas produced by the two batteries and of delivering it against a normal back pressure of 2½ lb. per sq. in.

One exhauster is normally in operation, the other acting as a standby. Each exhauster is direct-coupled to a steam turbine operating with steam at 150 lb. per sq. in. pressure and exhausting against a back pressure of 15 lb. per sq. in. A regulator controls the hydraulically operated steam throttle valves and maintains a constant vacuum in the gas inlet.

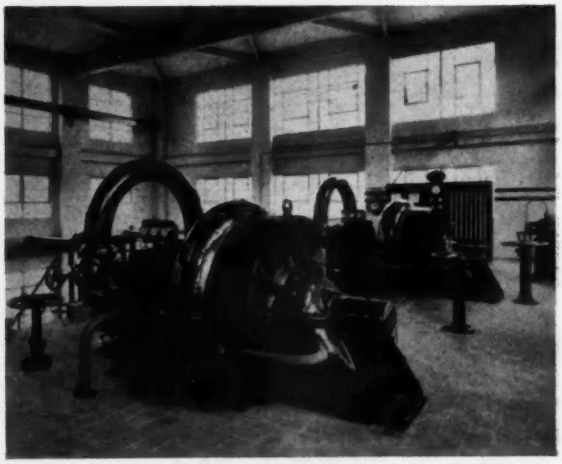


Fig. 4. Exhauster platform showing two steam turbine driven exhausters with gas suction regulator and instrument panel.

Fig. 5. Primary coke screen.

Coke Discharging and Quenching

The hot coke discharged from the ovens is received in a coke quenching car which has ample capacity to hold a complete discharge from one oven. The body of the quenching car is of steel and is approximately 40 ft. long between the end plates. It is mounted on a structural steel undercarriage having two four-wheeled bogies for running on a standard gauge track. The floor of the sloping bottom and the end frames of the car are lined with cast iron plates of special analysis to withstand sudden temperature changes. There are two side discharge doors of cast steel extending the full length of the car each of which is separately operated by a compressed air cylinder controlled from the electric locomotive cabin.

The coke quenching car, with its load of hot coke, is pushed to the quenching station where a pre-determined quantity of water is sprayed on to the coke to quench it.

The quenching station is of the re-circulation type with a brick wind shield and tower rising 100 ft. above rail level and with reinforced concrete settling sumps. A 10,000 gal. overhead tank supplies the quenching water to a series of special sprays through a hydraulically operated quick opening valve controlled automatically by the coke quenching car as it enters the station.

Two electrically operated centrifugal quenching water pumps deliver water from the pump sump to the quenching tank. Each pump has a capacity of 30,000 gal. of water per hour and one acts as standby to the other. They are operated automatically by a float in the overhead quenching tank. The pumps are located in a concrete well built below ground level to provide a flooded suction. A brick house is built over the well.

Coke Handling and Screening

After quenching, the coke car is run to the inclined coke cooling wharf and the quenched coke discharged thereon. The coke wharf is some 160 ft. long and of reinforced concrete construction. It is surfaced with Accrington Norri-ware bricks laid on edge. The regulating gates through which the cooled coke is fed are of steel and are hand operated from a platform extending the length of the wharf. This platform is protected by a concrete canopy.

The coke wharf conveyor is a 36 in. belt conveyor and it delivers the coke direct to the primary coke screen in the primary screening station. This screen is a single deck vibrating screen separating the coke at 2½ in. and it has a capacity of 75 tons of run-of-oven coke per hour. A second primary screen to serve a second coke wharf will be added in the future and the screening station has been designed to facilitate this extension.

The oversize coke from the primary screen is delivered by chute on to a 42 in. belt conveyor which, in turn, delivers it on to a 42 in. furnace coke boom loader whereon it is lowered into wagons on a rail track close to the secondary screening station. Alternatively the oversize coke can be fed into a coke cutting machine and reduced in size to −1 in. The undersize coke from the primary screen—plus the cut coke from the cutter when in use—passes to a 36 in. belt conveyor which delivers to the secondary coke screening station.

There are four coke screens at the secondary screening station. The first is a single deck vibrating screen separating at 1½ in., which delivers the oversize, via a chute, to the hopper below and the undersize to a 36 in. belt conveyor. The second screen is also a single deck vibrating type which receives the coke from this conveyor and separates it at 1 in., passing the oversize, via a chute, to the hopper beneath and the undersize to the first of two reciprocating screens arranged in line. These two screens grade the coke into the following sizes: 1 in. to ¾ in.; ¾ in. to ⅜ in.; ⅜ in. to ¾ in.; and ¾ in. to 0 and deliver direct into their respective compartments in the storage hoppers beneath.

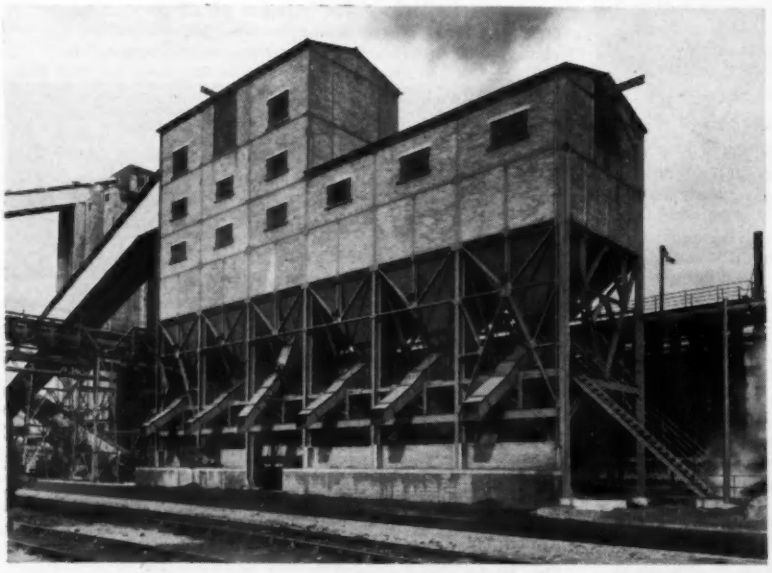


Fig. 6. Secondary coke screening station with ovens battery behind.

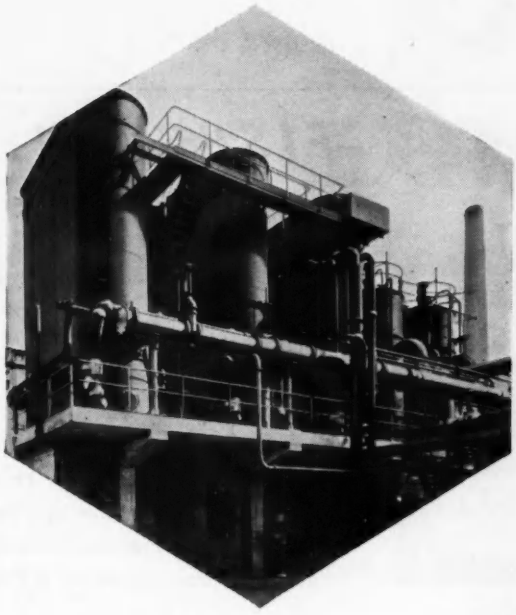
The secondary screening station is a steel-framed brick-panelled structure built over the range of storage hoppers. There are six hoppers and each has a storage capacity of 30 tons. The vertical walls and divisions are of 9 in. brick and the steel plate hopper bottoms are lined with blue tiles. Discharge gates and outlet chutes are provided so that each grade of coke, with the exception of breeze, can be delivered either over an electrically driven debreezing screen into rail wagons or, alternatively, over a fixed debreezing screen into road lorries or to the two weighing and bagging machines on the bagging platform.

Ammonia Saturators and Acid Separators

From the electro-detarrers the gas passes through a re-heater before entering the ammonia saturator, two of which are provided, one acting as standby.

The saturators, which are designed to produce a large crystal salt, are of 12 ft. 6 in. diameter and supported on structural steel columns. They are of welded steel construction, lead lined and also

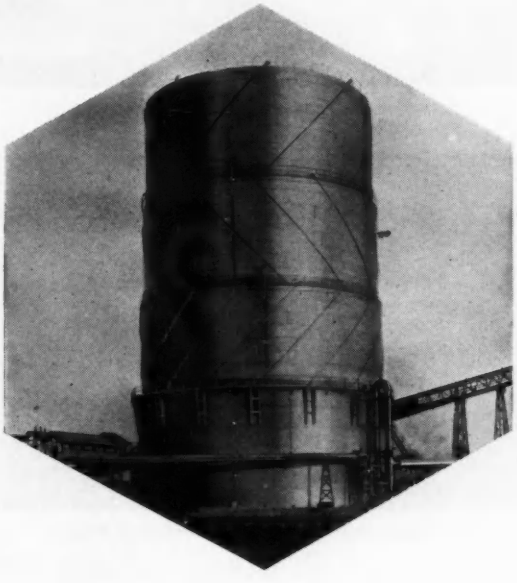
--- WHESSOE -- at FISHBURN ----------



WHESSOE fabricated and erected to the order of the WOODALL-DUCKHAM Company, the following plant for the N.C.B. Carbonisation Plant at Fishburn.

Primary Coolers: Three mild steel welded vertical tube multi-pass primary condensers operating in parallel, fabricated to W-D designs.

Electro-detarrers: Two W.W-D electro-detarrers, designed for a peak load of 14.75 mill. cu. ft. per day with 100% stand-by at normal loads.



Gasholder: One 500,000 cu. ft. capacity 3 lift spiral-guided welded gasholder. This holder was designed to throw approximately 17" W.G. total pressure, with the inner lift throwing 9" W.G., to provide adequate pressure at the coke ovens.

A notable feature of the welded construction was the 5% radiographic check on the welding in the tank. This was carried out by one of the Whessoe Mobile Radiographic Units.

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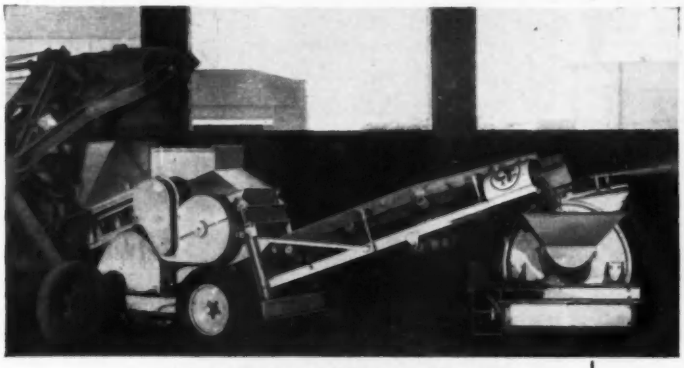

Photograph by courtesy of N.W. Gas Board Preston Works

OXIDE BREAKING

C. & T. Mobile Equipment receiving from a mobile shovel oxide in hard lumps up to 18" cube, and reducing it down to 80% minus ⅛" size. This equipment, which has a capacity of 30 tons per hour, consists of the C. & T. "Bigrampus" Mobile Crusher-Feeder and the C. & T. Mobile Disintegrator. *Two men only* are required to achieve this high hourly output, namely the mobile shovel driver and the man who tends the two C. & T. machines.

Photograph by courtesy of N.W. Gas Board Wallasey Works

OXIDE CONVEYING

A mobile shovel delivering prepared oxide to a C. & T. Standard Feed Unit which transfers the oxide to a chain of C. & T. "Foxhound" Conveyors. The last "Foxhound" discharges direct into a purifier box. The C. & T. machines can handle the oxide as fast as the men in the purifier boxes can spread it.

C. & T. equipment as illustrated above has been selected by the National Coal Board for the Fishburn Gas Works.

WE WILL BE GLAD TO SEND YOU FULL PARTICULARS OF THE COMPLETE RANGE OF C. & T. HANDLING EQUIPMENT WITH CAPACITIES FROM 2 TO 30 TONS PER HOUR, ON REQUEST.

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GAS EXHAUSTERS AT FISHBURN

For the National Coal Board's new Carbonisation plant, British Thomson-Houston supplied (to the order of Woodall-Duckham Construction Co., Ltd.) the two turbine-driven, direct-coupled gas exhausters. Each unit is rated for a normal volume throughput of 485,000 cubic-feet-per-hour, with a peak rating of 615,000 cubic-feet-per-hour.

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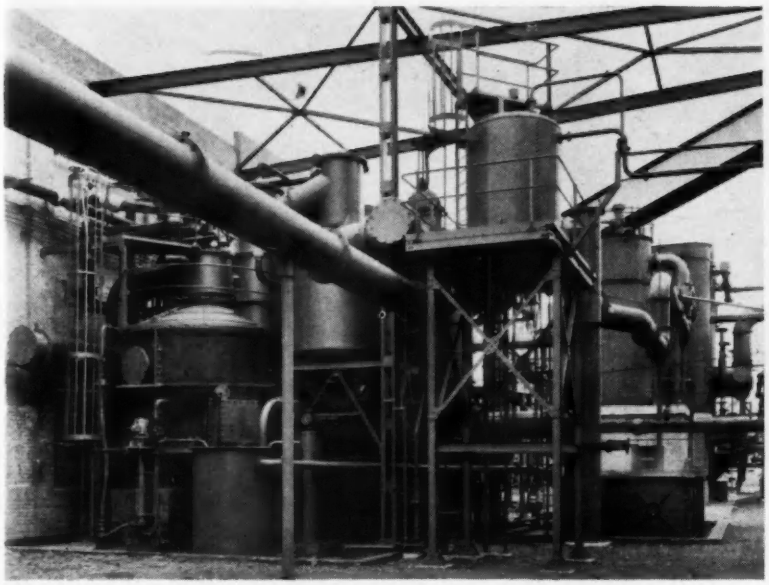


Fig. 7. Saturators with, in the background, Whessoe W-D. electro-detarrers and primary coolers.

tile lined. The gas enters via the cracker pipes and bubbles through the sulphuric acid contained in the saturators and passes to separators where any traces of entrained acid are removed. The cracker pipes, and the continuous overflow weirs and piping are all constructed of Monel metal. Within the saturator a distribution ring admits gas under pressure which agitates the liquor and crystals and, together with the arrangements whereby the liquor is heated and re-circulated, assists the formation of large crystals. The distribution ring and piping from the gas injector are of stainless steel. The acid separators are homogeneously lined with lead and provided with Monel metal acid catch pipes. Two acid separators are provided, one for each saturator.

The saturators and separators are in the open and stand over a concrete tray sloping to a concrete sump. Both tray and sump are protected with lead and acid resisting tiles.

Two electrically driven two stage air compressors supply the compressed air for use in the sulphate ejector. One is normally in operation and its capacity is sufficient for the plant when it is duplicated in the future.

Sulphate Drying and Bagging

In the centrifugal driers the large crystal sulphate is washed free of acid and partially dried. There are two driers, one of which is normally in operation with the other as standby, and they are of the suspended self-balancing type with a charge capacity of about 800 lb. of sulphate. The casing, basket and discharge valve are of 'Staybrite' steel and a sheath of the same metal protects the spindle. Each centrifuge is driven by an electric motor through a scoop controlled fluid coupling and is fitted with a plough discharge.

From the centrifugal driers the sulphate is fed by a 20 in. belt conveyor to the sulphate drying and neutralising machine. This conveyor has been arranged so that it will receive salt from the third centrifugal machine to be added in the future without modification. The sulphate neutraliser and drier is a rotary louvre type machine with a capacity of 30 tons per day. This capacity is sufficient for the duplicated plant of the future.

The by-product plant building is sub-divided to form the exhauster house, sulphate house and sulphate store. It is a steel-framed brick panelled building with the external faces of the steelwork brick-enclosed. The exhauster house is large enough to receive the additional exhauster and pumps for the extended plant of the future and is provided with a 3 tons capacity crane with overload runway.

Ammonia Still, Final Cooler and Benzole Scrubbers

The ammonia liquor condensate from the primary coolers, etc., is distilled in a still standing in the open. The free leg of the still contains six trays and the fixed leg nine trays. There is a lime chamber for mixing lime water and ammonia liquor. An orifice type meter is provided to measure the ammonia liquor entering the still which is also equipped with a waste-liquor trap. The ammonia gas distilled from the liquor is conveyed by pipeline to the inlet of the saturators. The lime mixing apparatus and pumps are contained in a separate building which also serves as a store. The apparatus comprises a lime mixer with an electrically-driven agitating device, a two compartment lime slacking box and two steam-driven ram type lime water pumps one acting as standby.

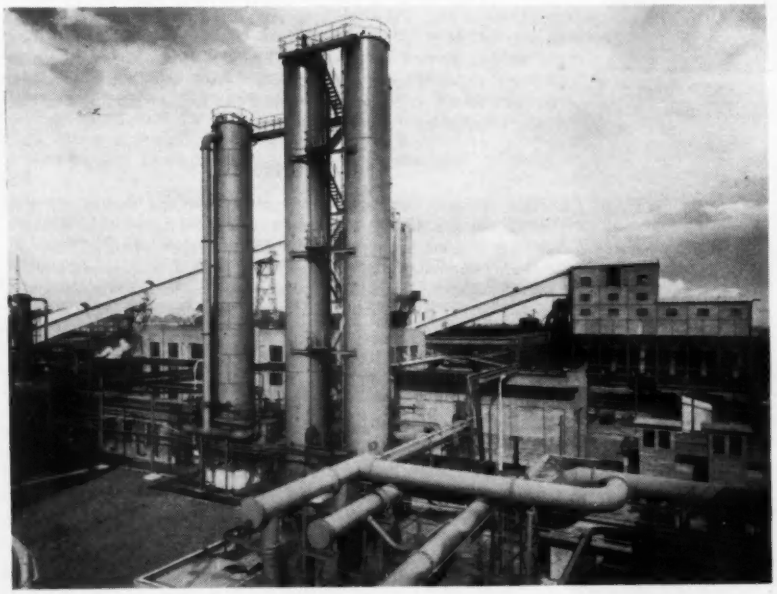


Fig. 8. General view from purifiers showing final cooler and benzole scrubbers; in the distance, exhauster and sulphate house.

After leaving the saturators and acid separators the gas passes through the final cooler where it is cooled prior to benzole extraction. The cooler is of the direct type with a number of sections of timber grids and is approximately 80 ft. high. The base of the cooler is provided with a tar leg through which the cooling water is passed for the removal of the naphthalene it contains. The tar section is steam heated.

From the final cooler the gas passes through a water separator to the two benzole scrubbers wherein it travels in series in an upward direction meeting a downward travelling stream of wash oil which absorbs the crude benzole.

Benzole Recovery

The wash oil from the scrubbers, enriched with benzole, is passed through two vertical tube vapour-to-oil heat exchangers, normally working in series but each capable of being by-

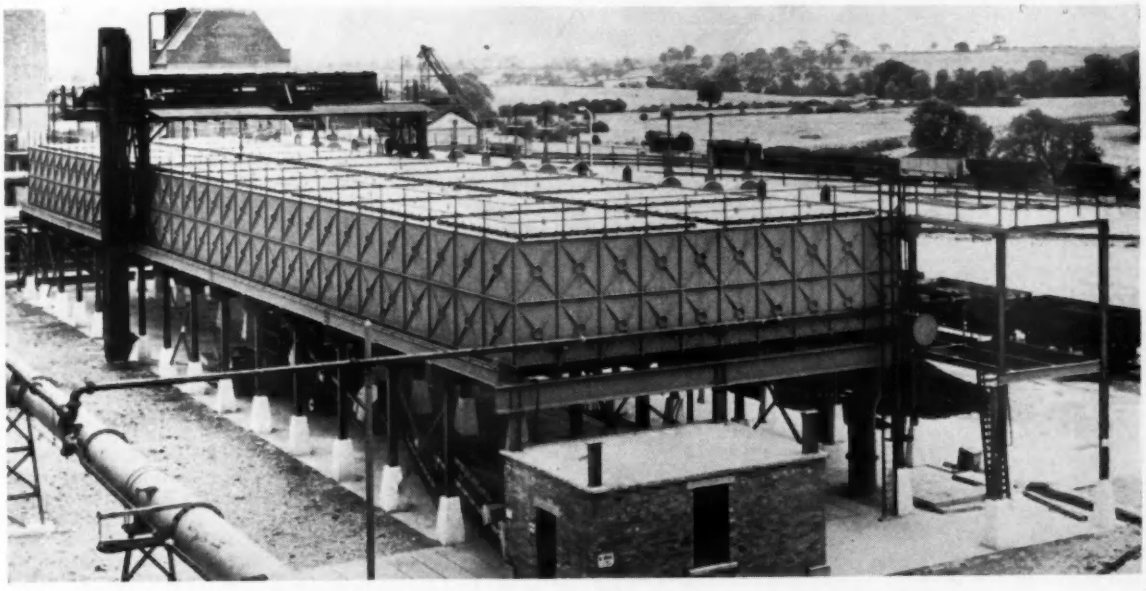
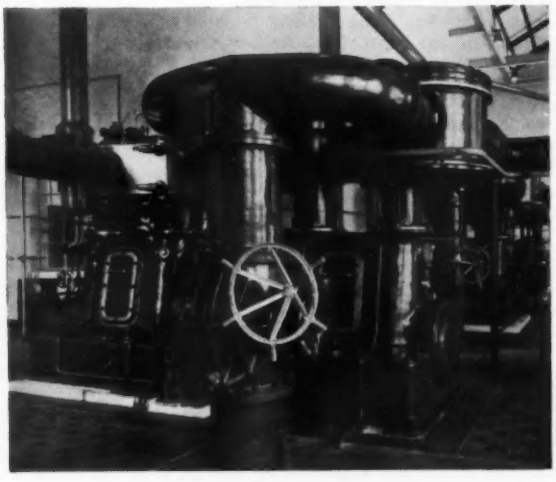
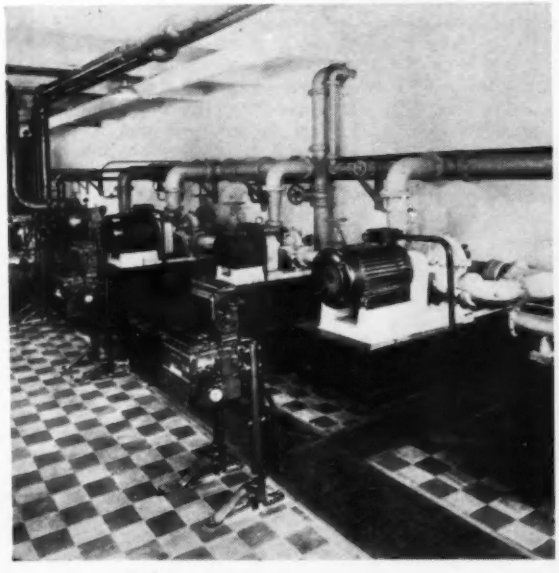


Fig. 9. Box purifiers showing oxide handling plant and cover lifting apparatus.





passed. In these heat exchangers heat is transferred from the crude benzole vapours leaving the still to the benzolised wash oil. The enriched wash oil is then steam heated in either of two final heaters and enters the cast-iron wash oil still. The still, which is 5 ft. in diameter, deals with the whole of the wash oil and has a series of fourteen trays where the crude benzole is removed by intimate contact with steam. A small portion of the de-benzolised wash oil is passed through a wash oil purifier for conditioning. The hot oil from the still is pumped through a wash oil cooler before re-circulation to the scrubbers. The wash oil cooler is of the open type and arranged so that any of its banks of piping can be by-passed and steamed out if necessary. The crude benzole vapour passes from the still through the vapour-to-oil heat exchanger to the open type crude benzole coolers. From the cooler the crude benzole passes through a separator and either to storage or, through a lifter, to the CS_2 still.

The CS_2 still is of cast-iron and consists of a bottom section with thirteen stripping and an upper section with twenty-seven rectifying sections the whole surmounted by a reflux chamber. In the still CS_2 is removed from the benzole which is then cooled and passed to storage. The CS_2 from the still passes through a condenser to a decanter from which a portion is returned to the reflux chamber and the remainder flows to the drumming tank.

Dry Purification

After passing through the scrubber and oil separator, that part of the gas which is required in the Northern Gas Board's mains is treated in box purifiers for the removal of H_2S. The purifiers were designed, constructed and erected by Newton Chambers and Co., Ltd., Thorncliffe, nr. Sheffield, and have a capacity of 7 mill. cu.ft. of coke oven gas per day.

The installation consists of five cast-iron purifiers, each 40 ft. × 35 ft. × 10 ft. deep, carried on a mild steel sub-structure. Each purifier has two 3 ft. 6 in. deep layers of oxide, and the gas connections are arranged for divided gas flow, the gas entering between the two oxide layers. The gas connections are 30 in. bore, and ten 30 in. bore 3-way valves are provided to give backward rotation of the boxes.

A primary gas heater of the Newton needle steam heated type is installed in the main inlet, and a secondary heater at the inlet to each box. A 30 in. by-pass, with three valves is provided to each heater. A steam manifold running the full length of the purifiers supplies the steam required by the

Fig. 10 (left above). The three gas boosters.

Fig. 11 (left below). Water pump room.

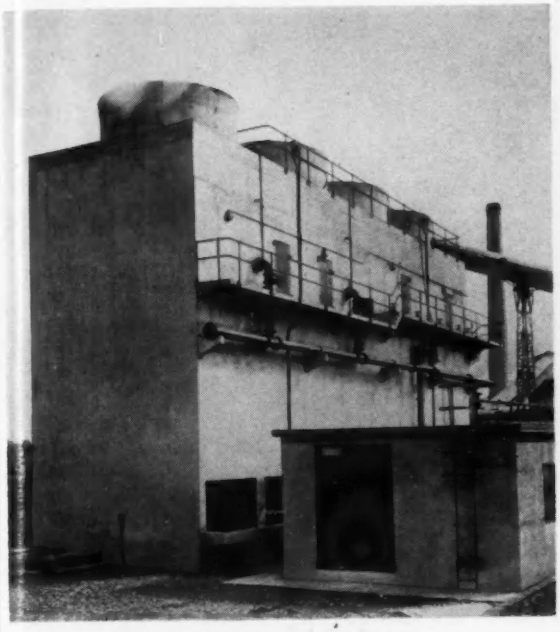


Fig. 12. Water cooling towers.

heaters, and in addition, a live steam branch with a hand control valve is provided at each purifier inlet for live steam admission.

For discharging oxide, there are four oxide chutes to each purifier, arranged centrally with respect to the cover openings. A novel feature of these chutes is that they are designed to automatically vent the space between the two layers of oxide and the space beneath the lower layer of oxide when the purifiers are opened for discharging of oxide, thus obviating the need for special vent doors. Charging of oxide is carried out by means of a combined oxide handling plant and cover lifting apparatus manufactured by Robert Dempster and Co., Ltd., Elland, Yorks.

In addition, there is a comprehensive mobile oxide handling plant, of Crone and Taylor, Ltd., manufacture, to assist in handling and preparation of oxide. The whole of the oxide handling plant is designed for a discharge rate of 20 tons of oxide per hour, and a charging rate of 40 tons per hour.

Air for revivification of oxide in situ is provided by two Keith Blackman steelplate turbo blowers, each having a capacity of 14,000 cu.ft. of free air per hour, one machine being in operation at any one time, the other acting as standby. An air manifold runs the full length of the installation, and a control valve is provided at the inlet to each purifier. The two blowers are fixed in a small house at one end of the installation.

The quantity of air delivered to the purifiers is measured by an orifice plate type meter. The temperature of the gas at the inlet to the primary gas heater, at the inlet to each purifier, and at the main outlet is measured by a potentiometric type temperature indicator. Six 48 in. w.g. manometers indicate the pressure at the inlet to each purifier and in the main outlet. These instruments are of George Kent's manufacture, and are mounted on a cubicle type instrument panel situated in the air blower house.

Newton Chambers and Co., Ltd., were also main contractors for the purifier foundations and blower house, the actual construction work being carried out by the F.C. Construction Co., Ltd., Derby. The foundations consist essentially of the footings to the sub-structure supporting columns, together with a ground level concrete floor for handling and preparation of oxide.

Boosters

It is visualised that some 7-7½ million cu. ft. of gas per 24 hours will be pumped from this station to gasworks at Stockton and elsewhere and provision has been made for compressing the gas to any pressure up to 30 lb. per sq. in.

To meet these conditions, three Belliss and Morcom gas compressors are installed. Each of these compressors is capable of taking in and compressing 5.3 million cu.ft. of purified gas per 24 hours to a pressure of 30 lb. per sq. in. When compressing to lower pressures, the quantity of gas dealt with is increased. Two of the compressors are driven by Mather and Platt synchronous motors which run at a constant speed of 333 r.p.m. and are direct coupled to the compressors. The third compressor is driven by a Belliss and Morcom steam engine which is fitted with variable speed gear so that the speed of the compressor, and thus its output, is varied automatically to maintain a predetermined pressure in the gas main. This predetermined pressure is variable between 5 lb. per sq. in. and 30 lb. per sq. in.

The Belliss and Morcom compressors are of the two crank, two cylinder, double acting, single stage type totally enclosed and fitted with forced lubrication to all working parts. The cylinders are water-cooled and the gas is delivered to the gas main through aftercoolers, which reduce the temperature of the gas to within about 15°F. of the inlet cooling water temperature.

As it is not possible with a constant speed motor to vary the speed of the motor-driven compressors, these machines are fitted with special relay operated controls which, if required, will vary the gas quantity entering the compressors according to the gas demand. Generally speaking, however, it is anticipated that one motor-driven set will run continuously at full load and the speed variation required to meet a fluctuating load somewhere between 5 million cu.ft. and 7½ million cu.ft. per day will be done by the steam engine driven set. The third compressor, with its motor drive, will be a standby plant and thus provision is made for a full 24 hour per day continuous service from two plants when any one of the three is shut down for examination or cleaning.

Water Softening Plant and Boiler Plant

Water pumped from the High Harvey Seam at Fishburn Colliery into an intermediate storage reservoir is of high hardness, with a tendency to encrustation. It is necessary to soften this water for steam raising purposes and also for use as make-up in the cooling water system where tubular and jacketed coolers are installed.

The plant provided for this purpose is of the John Thompson-Kennicott, cold process type, with main reaction tank, ground proportioning gear and mechanical filters. It has a capacity of 20,000 gal. per hour and employs as chemical reagents the following: hydrated lime, 1.8 lb. per 1,000 gal.; soda ash, 1.3 lb. per 1,000 gal.; and sodium aluminate, 0.15 lb. per 1,000 gal. The reaction tanks are constructed throughout from mild steel plates of welded assembly and mechanised agitation is provided for in the design.

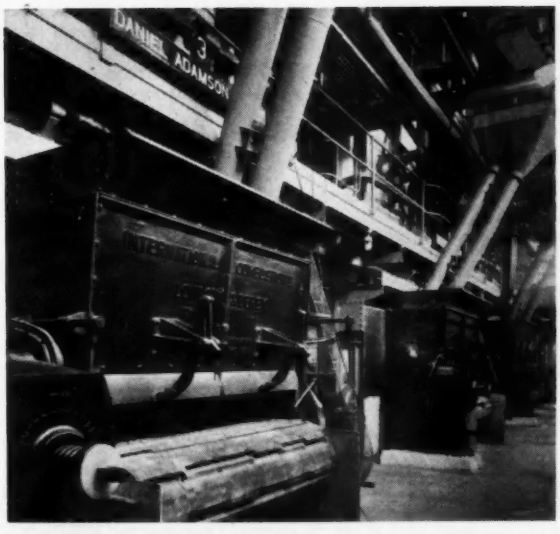


Fig. 13. Firing aisle in boiler house showing three water-tube boilers.

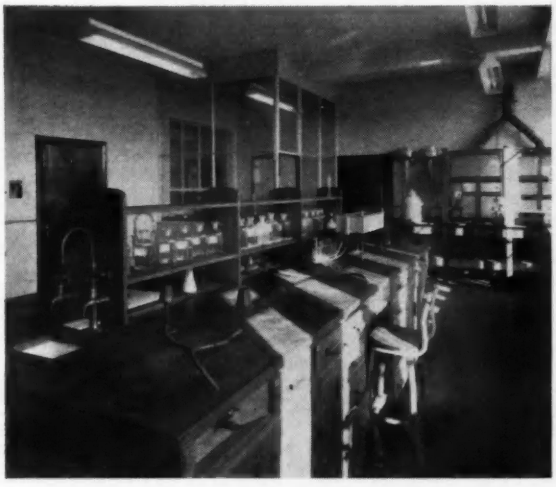


Fig. 14. A view in part of the laboratory.

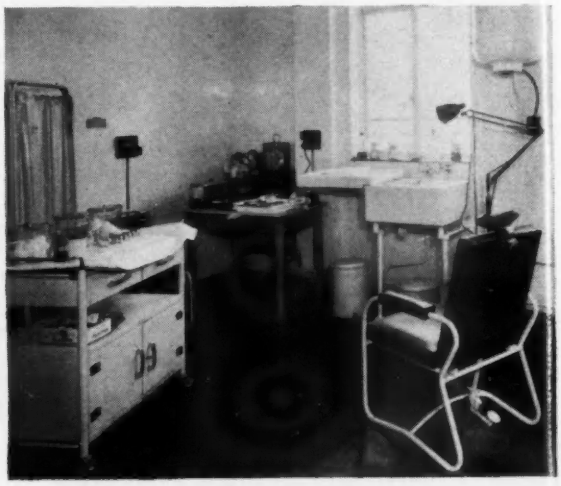


Fig. 15. A corner of the first-aid room.

The boiler installation at Fishburn consists of three Daniel Adamson water tube boilers housed in a boilerhouse, one wall of which is a temporary structure to allow for the addition of further boilers. The rated capacity of each boiler is 20,000 lb. per hour at normal load, 25,000 lb. per hour at maximum load, at a steam pressure at the superheater outlet valve of 180 lb. per sq. in. and a steam temperature at the superheater outlet valve at maximum load of 540°F., with a feed water temperature before feed heating of 60°F. The boilers are designed for an efficiency of 78% at normal load.

The boilers are of the bi-drum pattern, i.e., they are equipped with one top steam and water drum and one bottom water drum. There is also a front header which takes the place of the front steam/water drum of the tri-drum pattern boiler. The superheater, of the self-draining type of Unit Superheater Co., Ltd., manufacture is located in the convection zone, screened by the front bank of generating tubes. The superheater elements are expanded into the top drum at the inlet end and into the superheater outlet header at the outlet end.

Behind the boiler there is an economiser of the gilled-tube pattern manufactured by E. Green and Son, Ltd., arranged in two banks and working on the counterflow principle whereby the hot gases flow downwards and water upwards. The economiser is provided with a by-pass duct and there is also a feed water by-pass for the economiser.

The boilers are arranged for firing with coal and coke on the sandwich system and there are also coke-oven gas burners for use with or instead of coal/coke firing. The coal and coke receiving hopper is situated immediately outside the permanent end of the boilerhouse in a position which allows direct unloading of coal and coke from railway trucks into the receiving hopper. The coal and coke handling plant consists of a skip hoist which receives the fuel from the bottom of the fuel receiving hopper valve and discharges it on to an overhead moving belt conveyor. Each boiler is provided with a double bunker, separate compartments for coal and coke, respectively, into which fuel is discharged from the overhead moving belt conveyor by means of a travelling tipping gear. From the bottom of these bunkers, oscillating fuel chutes take the coal and coke to an International class 'L' travelling grate type stoker.

Treated feed water is brought into the boilerhouse and after passing through a heating system, which includes a cascade heater, is collected in a feed water storage tank which serves all three boilers. The flow of water into the tank is regulated by a float valve. Weir vertical steam driven feed water pumps take water from the tank and supply the three boilers.

The main steam pipe from each boiler takes superheated steam from the superheater outlet header to a bus main which runs along the rear wall of the boilerhouse. The steam ranges to the using points are connected to this bus main. The boilers are equipped with a full set of Clyde soot blowers of the hand-operated type.

Each boiler is provided with a set of instruments mounted on a panel comprising a steam pressure gauge, a steam flow meter, a six-point temperature recorder, a CO_2 recorder, five draught gauges, and a remote water level gauge.

Main Sub-Contractors to the Woodall-Duckham Construction Co., Ltd	
Piling	John Gill Contractors Ltd.
Coal Blending Bunker, Coal Storage Bunker, Water Cooling Tower	A. Monk and Co. Ltd.
Railways and Sidings	Thomas Summerson and Son Ltd.
Oven Machines	Wellman Smith Owen Engineering Corporation Ltd.
Water Cooling Tower Design	L. G. Mouchel and Partners Ltd.
Electric Locomotive	Robert Stephenson and Hawthorne Ltd.
Coal and Coke Conveyors	W. J. Jenkins and Co. Ltd.
Coal Weighbridge	Henry Pooley and Sons Ltd.
Vibrating Coke Screens	Fraser and Chalmer's Engineering Works
Reciprocating Coke Screen	W. J. Jenkins and Co. Ltd.
Breeze Hoist	Vaughan Crane Co. Ltd.
Coal Crushers	British Jeffrey Diamond Ltd.
Coke Cutting Machine	Robert Cort and Son Ltd.
Liquor Circulating Pumps	E. N. Mackley and Co. Ltd.
Tar, Liquor and Water Pumps	Gwynnes Pumps Ltd.
Tar and Lime Water Pumps	Joseph Evans and Sons (Wolverhampton) Ltd.
Acid Pumps	British LaBour Pump Co. Ltd.
Gasholder	Whessoe Ltd.
Gas Meter	George Kent Ltd.
Exhausters	British Thomson-Houston Co. Ltd.
Electro-Detarrers	Whessoe Ltd.
Centrifugal Driers	Watson, Laidlaw and Co. Ltd.
Sulphate Neutralising and Drying Machine	Dunford and Elliot (Sheffield) Ltd.
Gas Pressure Regulators Air Compressors	Reavell and Co. Ltd.
Electrics	Marsh Bros. Ltd.

Main Contractors Direct to the National Coal Board	
Producer Gas Plant	Gibbon Bros. Ltd.
Purifiers	Newton Chambers and Co. Ltd.
Boiler Plant	Daniel Adamson and Co. Ltd.
Gas Boosters	Belliss and Morcom Ltd.

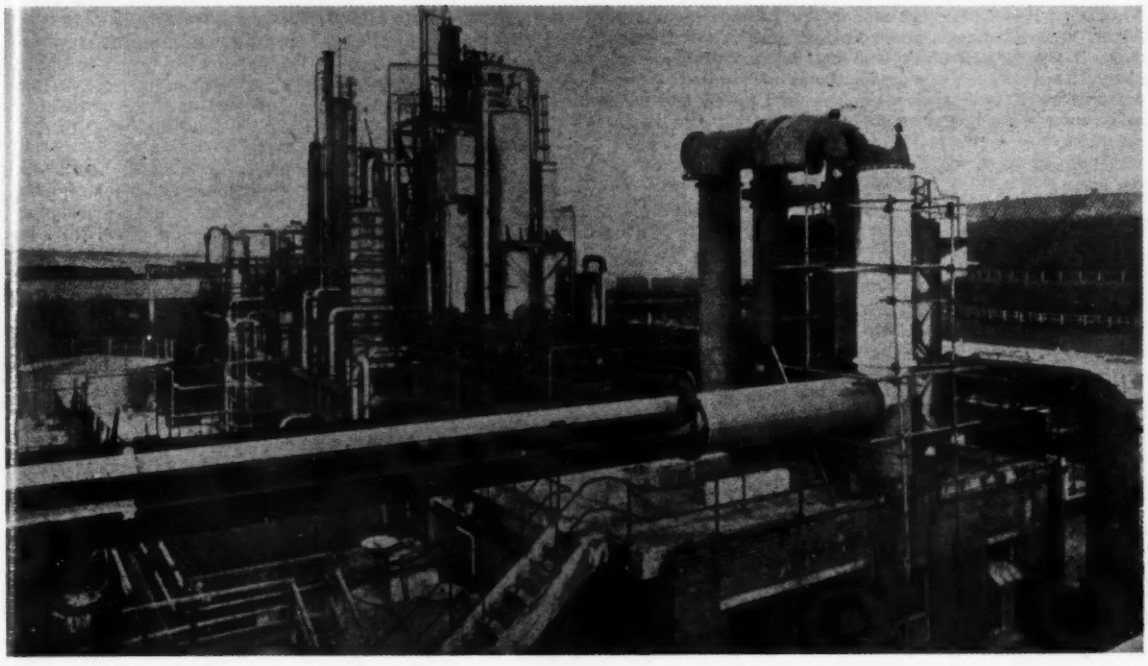
Water Cooling and Recirculating Plant

Raw water for the plant is drawn from the existing reservoir by either of two electrically driven centrifugal pumps, each of 30,000 gal. per hour capacity, one pump acting as standby to the other. The bulk of the water used on the plant is recirculated, make-up being supplied from the raw water pumps after passing through a treatment plant.

An induced draught cooling tower is provided to deal with two separate circuits, there being two cells for water used on the primary coolers and miscellaneous duties and two for water which comes into direct contact with the gas in the final cooler. A decanting tank is arranged in the direct cooler circuit to intercept any tar which may be entrained in the water leaving the final cooler.

Five motor driven centrifugal pumps are supplied for recirculation of water, two in the primary circuit of 60,000 gal. per hour capacity and three in the final circuit of 25,000 gal. per hour capacity. In each case the recooled water is pumped to the apparatus from the respective cold well below the cells Warm water from the primary coolers returns by gravity to the cooling tower but in the final cooler circuit a pump is used after the decanting tank to deliver the warm water to the tower.

(*Continued on page 472.*)



Tingley Liquor Effluent Treatment Plant*

By P. C. EGAN, B.Sc.†

THE new gasworks at Tingley was originally planned by the United Kingdom Gas Corporation. The land was scheduled for gas manufacture in 1946. Approval was given by the Local Planning Authority in 1947 for the general development of the whole of the Tingley site. Site preparation was started in 1948 and gas-making commenced at the beginning of 1953.

The original conception of the Tingley works was that it should ultimately produce 14 mill. cu.ft. of gas per day from intermittent vertical chamber ovens. The plant was to be built in two halves, each of 7 mill. cu.ft. of gas per day. The construction of the first installation was well advanced at vesting day and this plant, including the liquor treatment plant designed to deal with the liquor from 7 mill. cu.ft. of gas per day, became vested in the North Eastern Gas Board. The liquor plant and equipment provided for the full treatment of the ammoniacal liquor in such a manner that the final effluent was to be innocuous and acceptable to the Rivers Board.

The effluent treatment process was devised owing to the fact that the sewage disposal works at Morley, in which area the Tingley plant was situated, was unable to take the effluent from the proposed Tingley works regardless of whether such effluent be raw ammoniacal liquor or waste liquor from a concentrated liquor plant. The quantity of waste liquor from the Tingley works was estimated to be some 15,000 gal. per day in the initial stage, rising to 30,000 gal. per day in the ultimate stage. Whereas the Morley sewage disposal plant would be able to deal with the waste liquor from a gasworks serving a population the size of Morley, it would not be able to take the effluent from the Tingley works, which initially would be capable of serving a population some 10 times that of Morley and ultimately a population 20 times as much.

The effluent treatment plant, as a composite unit, is unique, in so far as it is the first of its type, although the stages of treatment have previously been employed separately. The plant was conceived by the United Kingdom Gas Corporation and orders were placed with W. C. Holmes & Co., Ltd., for its construction and installation.

The plant was installed to perform the complete treatment of gas liquor so as to give a clean effluent of negligible O/A properties, for use as coke quenching water or for discharge to drain or stream, and to recover saleable products.

The sequence of operations is as follows:—

1. Monohydric phenols are removed from raw liquor by benzole washing. The benzole is recovered from the phenolic extract by distillation and is re-used.
2. Free ammonia is removed by distillation with steam. Carbon dioxide and hydrogen sulphide are also removed at this point.
3. The spent liquor is reduced in volume by evaporation in multiple effect evaporators, under reduced pressure. The condensate from this stage forms most of the final effluent.
4. Higher tar acids are removed from the liquor, after evaporation, by washing with butyl acetate. The solvent is recovered by distillation.
5. Ammonium chloride is recovered as salt after final evaporation and crystallisation. Thiocyanate and thiosulphate could be accumulated in mother liquor at this stage as a saleable product.
6. Traces of phenol which remain in the condensate from the evaporation plant are removed in the active carbon filters by adsorption. Spent carbon is washed free from phenol by hot benzole, followed by steaming out to remove benzole. Two filters are installed because of the cyclic operation involved.

Process heat for the plant is mainly derived from exhaust steam at 15 lb. per sq. in. Small high pressure steam requirements are served by the works supply. Cooling water is recirculated through a cooling tower.

From January, 1953, the plant was to treat liquor made at Tingley at half its rated capacity of 600 gal. per hour, since the initial gas-making rate was to be 3½ mill. cu.ft. per day.

The plant has been in operation dealing with the crude liquor as produced from I.V.C.O.s of 7 mill. cu.ft. per day since

* Abstracted from a paper to the Manchester and District Section of the Institution of Gas Engineers, November 5, 1954.

† Chemical Engineering Assistant, North Eastern Gas Board.

November, 1953, taking out monohydric phenols, concentrated liquor, and discoloured ammonium chloride as saleable products, but without washing with butyl acetate for polyhydric phenols, and without passing the final condensate through the carbon filter. The final condensate is used for augmenting the coke water quenching system. Oxidation in one stage is practised.

Costs of Processing

The costs of the process as so far operated, and based on the quantitative results of a 25-day test run, are as follows:—

		£ s. d.	£ s. d.
1.	Wages, Process	142 9 4	
2.	Wages, Repair and Maintenance	80 14 3	
3.	Technical Supervision	53 17 1	
4.	Insurance, Holidays, etc.	17 17 0	
5.	Materials, Process	52 2 11	
6.	Materials, Repair and Maintenance	84 1 4	
7.	Electricity, 11,700 units at 1.006d. per unit	49 0 10	
8.	Water, 63,000 gal. at 1s. 9d. per 1,000 gal.	5 10 3	
9.	Steam, L.P. at 4s. 7d. per 1,000 lb. H.P. at 6s. 6d. per 1,000 lb.	633 10 6	1,119 3 6
10.	*Less:*— Sale of C.A.L. 1,616 units at 3s.	242 8 0	
11.	Sale of Ammonium Chloride 14.8 tons at £16 per ton	236 16 0	
12.	Sale of Phenol/benzole 688 gal. at 1s. 8½d.	59 9 8	
13.	Credit for water supplied for coke quenching 591,000 gal. at 1s. 9d. per 1,000	51 14 3	590 7 11
14.	Loss on process		528 15 7
15.	Capital Charges — 7.19% per annum on £85,000 (proportioned to 25 days)		418 15 10
16.	Cost of treatment over period		947 1 5
17.	Cost per 1,000 gal. crude liquor treated on 331,700 gal.		2 17 0
18.	Cost per therm of gas made = 0.3d.		

1. Process wages include for one man per shift, plus three extra shifts for days off each week. Actual time is charged.
2. Repair and maintenance wages cost is averaged from seven months operation.
3. Technical supervision is based on the major portion of a daytime technical assistant's time, together with part of a chemist's time and administration.
5. Process materials include benzole for dephenolation, ammonium sulphide for precipitation and flocculent.
6. Repair and maintenance materials costs are based on actual expenditure over seven months operation.
7. Electricity is metered at the plant.
8. Water make-up requirements of the cooling system are by direct measurement of levels in the cooling pond.
9. Quantities of steam used are by steam meters. The price of steam as charged is based on actual cost as raised in boilers fired with coke breeze. Low pressure steam is back pressure exhaust at 15 lb. per sq. in. from steam engines driving compressors, and credit is given for work done. No credit is given for waste heat steam. The average steam consumption over 25 days was:—
   H.P. steam—1,153 lb. per 1,000 gal. crude liquor.
   L. P. steam—6,699 lb. per 1,000 gal. crude liquor.
10. Based on units of ammonia recovered as C.A.L. and sold at basic price.
11. The price received for ammonium chloride discoloured salt as made is £16, loaded into customers' wagons. The quantity is that actually made over the 25-day period.
12. Based on the assessed make over the period, and the priced received for the mixture.
13. The 591,000 gals. quoted for quenching water is made up:—

From evaporated liquor	332,000 gal.
From cendensed steam and cooling water, blow down	259,000 gal.
	591,000 gal.

15. Capital charges are based on the actual installation cost, and include the phenol extraction by butyl acetate washing plant and the active carbon filtration plant, although these two sections of the plant were not used. If these two sections were excluded, then the capital charges would be reduced by £113 16s. 4d., or 6s. 10d. per 1,000 gal. of crude liquor treated.

Observations on Results

The main conclusions on results so far achieved are:—

(a) Crude liquor can be treated so as to result in either a final effluent suitable for use in quenching coke without undue deleterious effect, or, by the use of the final active carbon filtration plant, a final effluent of O/A less than two parts per 100,000.

(b) The net cost of the process as operated and assessed is excessive, and even prohibitive. It is felt, however, that reduction in the quoted costs could be achieved.

From the experience gained during the last two years, certain relevant observations may be put forward.

Crude Liquor.—The crude liquor treated during the test run on which results are based was unfortunately weaker than it should normally have been, and the overall costs are correspondingly high on this account.

The liquor treated is that produced from carbonisation in vertical chamber ovens, and there is no reason to believe that liquors produced with other systems of carbonisation would not be suitable for treatment by this method. Nevertheless, it would always be desirable when considering this method of treating gas liquor to investigate its gum forming properties thoroughly on a laboratory scale.

Steam.—Steam as charged is by far the largest item of cost. At Tingley sufficient waste heat steam is generated to satisfy the works requirements excluding the liquor treatment plant. To provide full works requirements including the liquor plant steam is generated in Lancashire boilers fired with breeze to augment waste heat steam to an extent on the average equal to the approximate requirements of the liquor treatment plant.

In the costs quoted, liquor treatment bears the full cost of Lancashire boiler steam. It may be argued that all works plant should bear equally cost of Lancashire boiler steam, and that liquor treatment should have an equal advantage with other plant and have a share of the cheap waste heat steam. The fact remains that at Tingley, but for liquor treatment, Lancashire boiler steam would not be required. The charge for steam depends on circumstances, and to some extent on opinion as to allocation. In order to show how the cost of steam and also the strength of crude liquor as variables affect the net cost of liquor treatment, other things remaining constant, Table I is given.

TABLE I.

COST PER 1,000 GAL. CRUDE LIQUOR TREATED.

Steam cost per 1,000 lb.	*Nil*	1s.	2s.	3s.	4s.	5s.
Liquor:—						
6-oz. strength	18s. 7d.	26s. 5d.	34s. 3d.	42s. 2d.	50s. 0d.	57s. 10d.
8-oz. ,,	9s. 1d.	16s. 11d.	24s. 9d.	32s. 8d.	40s. 6d.	48s. 4d.
10-oz. ,,	9d.	8s. 7d.	16s. 5d.	24s. 4d.	32s. 2d.	40s. 0d.

Saleable Products.—The net cost of processing is influenced largely by receipts for recovered products. A convenient market for concentrated ammonia liquor and phenolic product from the dephenolation plant is essential. Ammonium chloride is used for galvanising, battery making, and to some extent as a fertiliser. The market, from enquiries, would appear to be normally satisfied with little or no shortage of supply. Salt made at Tingley contains phenolic bodies which oxidise and discolour on standing, and is being sold at £16 per ton. The market price for pure crystal is about £25 per ton, but it is extremely doubtful whether more than £22 net could be obtained in practice. It is estimated that a second stage treatment of discoloured salt to make a good permanent white salt would cost approximately £4 per ton, which indicates an incentive to adopt the treatment at an advantage of £2 per ton and an ultimate reduction in the net cost of liquor treatment.

Operation of Plant

Dephenolation by Benzole Washing.—It is desirable in this section of the plant to remove the maximum quantity of phenol coupled with the minimum loss of washing benzole. It is essential from the point of view of cost to ensure that only the absolute minimum of benzole is lost with the phenol product. Not only must the plant be charged with lost benzole, but it will also suffer in that recovered phenol loses

market value if benzole is present. The use of suitable short range benzole will minimise the loss in this direction. This is because the benzole recovered from the phenolic extract for further use must contain a minimum amount of phenol, and this can only be accomplished by limiting the column head temperature to 80°C. If this temperature is exceeded the increasing proportion of phenol distilled over with the benzole adversely affects washing conditions in the dephenolating washer since the outgoing washed liquor under the most ideal conditions can only be in equilibrium with the ingoing benzole. It is concluded that short range benzole, which is in fact 90's benzole, is essential for dephenolation purposes, and in practice this may have to be prepared from a crude benzole in a separate distillation unit, which is precisely what is now being done at Tingley.

Free Ammonia Recovery.—The recovery of free ammonia in the form of concentrated ammonia liquor, which incidentally removes sulphides and reduces the O/A value of the liquor, is carried out in a normal type of plant which presents no difficulties and calls for no comment.

Evaporation.—The most important conclusion which can be drawn from the evaporation of the liquor effluent from the free ammonia recovery plant is that a deposition of gummy material results in the final effect on heating surfaces, with the subsequent loss of efficiency. Provision should be made in any new plant for counteracting the effects of gum deposits. Surface area for heat transfer in the evaporators and in particular the evaporator condenser, should be generously designed, since the deposits referred to interfere with the passage of heat. Blockage of pipes could possibly be avoided by arranging steaming and flushing points at bends, which are the most susceptible to choking. Steam will readily soften the gum which can then be flushed out with caustic soda solution in which it is soluble.

A regular weekly shut-down for cleaning and maintenance is essential if regular operation under optimum conditions is to be achieved. A period of two hours each week is found to be sufficient for this purpose. The major part of the plant can be kept hot ready for an immediate start up as soon as the work is finished. This period is also convenient for steaming out the concentrated ammonia plant where any carbonate accumulated during the previous week is washed out.

With regard to the benzole dephenolation plant, phenols with benzole accumulate in the benzole recovery still. The benzole is distilled off during the shut-down period, after which the previous week's make of phenol is run off to the stock tank. The still outlet is closed again and the whole is ready for a further week's operation. By this means the escape of recoverable benzole to the crude phenol stock tank is avoided.

From a design point of view it has been found that the float controllers for the feed between evaporation effects can be replaced by simple iron needle valves. These are inexpensive and require very little maintenance, and can be set to give the feed required with very little trouble.

Oxidation of Evaporated Liquor Using Air.—The crude chloride solution bled from the evaporation plant contains tar acids (polyhydric phenols), which must be removed if the ammonium chloride is to be recovered as a white stable crystal. The plant is designed and built provided for removal of tar acids by washing with butyl acetate and recovering the tar acids as a saleable product. This process was abandoned in favour of removal by oxidation, using air in the presence of ammonia.

It has been found that if the standing time given for oxidation to continue after blowing is extended to seven days, then the final salt is white and darkens only slightly to a grey colour. Storage capacity should be ample for these conditions and be so designed that tanks can be easily cleaned out at regular intervals. Cleaning is necessary as a good deal of gum is formed during the standing period.

It is necessary to filter the oxidised liquor to free it of this gum prior to crystallisation. An experimental coke filter was employed at Tingley, but a finer filtering medium is recommended, which would take the form of a small pressure filter containing fine medium, cheap enough to dispose of when soiled. Alternatively back flushing could be employed, when the question of the disposal of washings would require to be solved. The washings, which would contain ammonium chloride, might be returned to the crude chloride tank, where any particles would ultimately be settled out.

The oxidation process is being successfully carried out at Tingley, but it requires strict technical control.

Crystallisation.—Clean ammonium chloride solution, after oxidation, passing to the crystallising evaporator via a feed tank still contains traces of tar acids which are concentrated in the mother liquor produced during salt discharge. It has been found advisable to return mother liquor to the crude chloride solution before oxidation with air blowing. Gum is deposited from the mother liquor in this tank, due to cooling.

Final Purification—Re-crystallising Ammonium Chloride.—A permanent white salt can be produced by heating, dissolving, and re-crystallising, resulting in an increased revenue and a reduction in the overall costs.

Technical Control.—It has been the experience that nearly full time attention of a daytime technical assistant is required to control operation. Chemical testing on the plant must be done regularly, especially for the control of dephenolation and salt making. Testing usually absorbs one half of a chemists' time in the laboratory.

Labour Requirements.—It is necessary that shift operators should be available, and of a type suitable for controlling the involved operations, which require a good degree of intelligence and initiative. The duties of the trained shift operators include the maintenance of flows, temperatures, and any other conditions as prescribed by the technical assistant. A daily log sheet is kept in which readings are entered by the operator at two-hourly intervals. He is required to maintain a balanced throughput from one section to another and to ensure that stock and balance tanks neither completely empty nor overflow. Any faults or irregularities which might occur are either corrected by him or reported to the technical supervisor. The control of evaporation, oxidation, and crystallisation is in the hands of the operator, who also looks after the benzole extraction plant.

In addition to plant operators a labourer is employed during normal hours, for plant cleaning, greasing, the loading of road tankers and salt handling.

Maintenance.—Maintenance charges have been consistently high mainly for reasons previously described. However even with the plant in good mechanical order, the frequent attention of a fitter has been necessary. It is possible in view of experience and alterations made, that maintenance charges will be reduced.

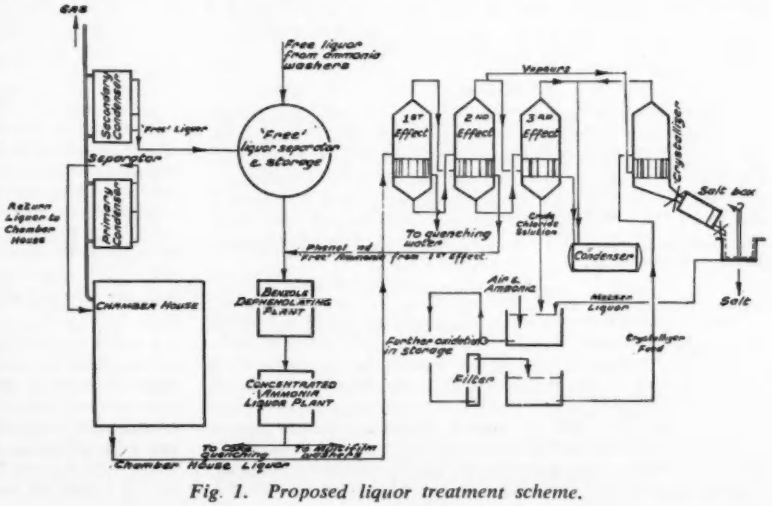


Fig. 1. Proposed liquor treatment scheme.

Consideration of Future Possibilities

Disadvantages in the process as now existing, and which reflect very strongly upon overall costs of treatment, are that the C.A.L. plant is required to deal with the whole of the crude liquor, and that the evaporators are required to deal with the whole of the effluent from the C.A.L. plant.

It is easy to see that if the crude liquor as made was separated with a sharp division, and treated independently as free liquor and fixed liquor, then the capacity for fully treating liquor would be greatly increased for the same size of plant, with a substantial reduction in the cost of treatment.

Such a proposal is shown diagrammatically in Fig. 1. Liquor as condensate from the primary condenser is used solely for chamber house circulation, and the chamber house overflow of fixed liquor is pumped directly for evaporation and crystallisation. Free liquor from the secondary condenser and ammonia washer is pumped directly to the benzole dephenolating plant and C.A.L. plant, the effluent from which would provide make up for the ammonia washer, the remainder being used for quenching. It will be obvious that such a method could only be considered when effluent from the free liquor treatment section of the plant cauld be used for quenching or for some other purpose. Oxygen-absorption value would prohibit its being discharged to stream.

At Tingley the ratio between the free and fixed liquors would be in the order of six to one, and could be varied by increasing the amount of fixed bled off from the chamber house if so desired. Condensate from the primary condenser is ample for re-circulation in the chamber house. Table II gives typical analyses of the various liquors at Tingley.

TABLE II.

TYPICAL ANALYSES OF LIQUORS.

Liquor source	Ammonia			Chloride as HCl	Phenol	Tar acids as catechol
	Free	Fixed	Total			
Primary condensers ..	0.49	0.10	0.59	0.233	—	0.031
Secondary condensers	1.68	0.11	1.79	0.278	0.475	0.037
Chamber house ..	0.45	2.88	3.33	2.244	0.379	0.260
Static washers ..	2.31	—	—	—	—	—

The table shows that sharp division between the fixed and free liquors is not possible. The fixed liquor contains free ammonia and monohydric phenol, which, however, would boil off with the first evaporation effect vapours, and return after condensing in the second calandria to the dephenolation plant feed.

The small amount of fixed ammonia present in the free liquor is unavoidable. The spent liquor for quenching will be mixed with steam condensate from the rest of the plant, and the final fixed ammonia concentration should be very small in consequence.

The saving in steam consumption would be equal to that which is now required to evaporate the main bulk of the effluent liquor from the C.A.L. plant, and would amount to approximately half the present total quantity.

With regard to throughput, the free liquor treatment plant would work independently of the evaporators, and it is safe to assume that the throughput would be increased by one sixth.

From these considerations the final total cost of liquor treatment is expected to be in the order of 33s. per 1,000 gal.

FISHBURN COKING PLANT—*Concluded from page 468.*

All of the cooling water pumps are housed in the pump room which has tiled floor and dado and is provided with a lift beam and trolley.

Foundations and Sidings

A soil survey of the site disclosed that the ground was incapable of carrying the heavy loads which would be imposed by the plant and it was decided to use piles to support the foundations. Because of the varying nature of the soil the cast-in-situ type of pile was selected and there are some 1,300 of these piles supporting the plant.

An extensive layout of railway tracks has been provided for the movement of coke and by-products wagons. Wherever possible the sidings are graded to give a gravity flow and the total length of track amounts to 4,000 yards.

Coke Oven Gasholder

The gasholder has a storage capacity of 500,000 cu.ft. of coke oven gas. It is of welded steel construction and of the three lift spiral guided type. Each lift is 35 ft. deep and the diameter of the outer lift is 82 ft. 9 in. Anti-freezing apparatus is provided for the cups. The orifice plate for the meter which measures the total gas made at the ovens is placed in the gas line after the benzole scrubbers and the meter is capable of dealing with 700,000 cu.ft. of gas per hour.

Gas Control

To maintain the flow of gas through the purifiers to the gas compressors, two Rateau star-type turbo-booster fans are installed. The motors and control gear only are housed and special wall boxes are provided for the extended drive shafts. One fan will normally be in operation, the second serving as a standby. Each fan has a capacity of 300,000 cu.ft. per hour, measured at 60°F. and 30 in. Hg. and is capable of delivering at an outlet pressure of +30 in. W.G.

Station Meter

One Holmes Connersville meter, size 22 in. by 66 in., of the positive displacement type and provided with labyrinth seals, is installed to measure the gas passing to the boosters. It is equipped with a counter driven by the impellor shaft, to give a reading of the gas passing in hundreds of cu.ft. The meter is equipped with a pressure, volume, temperature and time recording instrument to record on a circular chart the pressure, volume and temperature of the gas being metered. In addition to this meter, which is housed in a separate building, a Kent ring balance meter, indicating the gas flow in millions of cu.ft. per day, is installed in the gas compressor house for control purposes.

Cross connections between the inlet and delivery gas mains in the compressor house, fitted with suitable automatic relief valves, have been provided to safeguard plant and mains in the event of abnormal pressure or suction conditions. A Bryan Donkin excess pressure relief valve is set to open at pressures in excess of 31 lb. per sq. in. to safeguard the delivery main. Two valves are installed to maintain steady conditions on the inlet side of the compressors. A Bryan Donkin diaphragm pressure regulator will come into operation if the inlet pressure falls to +4 in. W.G. An Askania controlled close fitting butterfly valve is set to operate at +3 in. W.G. This latter valve is put on to hand control and used as a by-pass during periods of low output when only the constant speed motor driven boosters are available.

Gas Testing Station

A building has been provided for use as an official gas testing place. A Scientific and Projections, Ltd., Fairweather recording calorimeter is housed in a room with thermostatically controlled heating. A non-recording calorimeter is available in an adjoining room, together with other gas testing apparatus. There is access from a passage to the test rooms. The premises and apparatus conform to the Gas Examiners' General Directions, 1950, and have been approved by the Minister of Fuel and Power.

Services and Amenities

The whole of the Fishburn coking plant has been most effectively planned and not least in the services and amenities which have been provided for the smooth running of the plant and for the welfare of the staff. Among them are the administrative offices, the laboratory, the canteen and first aid room. In Figs. 14 and 15 are shown two views, one in the well equipped laboratory and the other in a corner of the first aid room, where, as can be seen, everything is to hand for the care of operatives needing medical attention.

LIGNITE IN SOUTHERN INDIA.—Extensive deposits of lignite, estimated at about 2,000 mill. tons, are reported to have been proved at Nieveli, Southern India. As part of the development scheme in this area, it is proposed to erect a coking and by-product plant. One ton of lignite with a 30 per cent. moisture content should yield a good-quality coke, 8 lb. of tar, 100 lb. of ammonia liquor, and a surplus of gas in excess of the internal consumption.

Alternative Gases in France

A free abstract of a paper presented to the World Power Conference in Rio de Janeiro this year by G. Combet and A. Bolzinger, both of Gaz de France, under the title, 'Realisation in the French gas industry, of the production from petroleum derivatives, of gases analogous to the town gas made from coal.'

The appearance of natural gas, consisting mostly of methane, also of gases such as propane and butane with combustion characteristics very different from those of coal gas or mixtures of coal gas and carburetted water-gas hitherto distributed, has shown that in a burner made for a given gas one cannot always use other gases. This is even more important in some industrial applications than in the case of domestic burners.

The use of the Delbourg 'combustion potential' and the Delbourg burner for the purpose of pre-determining the interchangeability of different gases in a given burner was explained at length in the I.G.E. Communication No. 404 presented in June, 1952 (see GAS JOURNAL, June 11, 1952, p. 687). It was shown that one gas can be substituted for another in a burner designed for the latter if their 'points' plotted on the Delbourg graph, with Wobbe indices as ordinates and the Delbourg 'combustion potential' as abscissae, lie within the same zone of the diagram, the extent of this zone being characteristic of the burner in question.

The gases or mixtures of gases which can be conveniently distributed by the gas industry falls into three main groups:

(1) Gases of the usual calorific value of the order of 4/5000 cals/m³ of which the prototype is the classic gasworks product with coal gas as basis.

(2) Rich gas having a calorific value of 9/10,000 cal/m³ of which the prototype is natural gas (oil gas and propane/air of the same calorific value).

(3) Very rich gases such as propane and butane.

In 1951, the calorific value of gas distributed was 98% of the 'classic' gases (group 1), 1.53% natural gas and 0.07% propane. Natural gas is used in the south western region only. Propane is used in small undertakings in an increasing number of cases, but still representing a very small percentage of the whole. However, an increasing use is being made of non-condensable and condensable petroleum derivatives available at the oil refineries, whether for direct distribution or as peak-load auxiliaries to the classic gases. Methods for achieving this are rapidly developing in France.

In Part 1 of their paper the authors set out the technical characteristics of the problem. Gasworks generally are sending out coal gas or mixtures of coal gas with water-gas or producer gas characterised by a high hydrogen content (40-50%) requiring, to give the average calorific value of 4,200 cal/m³ (440 B.Th.U/cu.ft.), an appreciable proportion of rich hydrocarbons—for instance some 20% of methane.

The average gas distributed in France has the following characteristics:

Composition	CO_2 3.7%, CnHm 2.7%, O_2 0.6%, CO 15%, H_2 45.2%, CH_4 18.9%, N_2 13.9%.
Calorific value (gross) ..	4,200 cal/m³ dry at 0° C. (440 B.Th.U./cu. ft. saturated at 60° F.).
Density	0.52.
Wobbe Index	5,800.
Delbourg potential ..	85 (JOURNAL July 23, 1952, p. 199).

Generally, the treatment of heavy petroleum derivatives, particularly oils, to give the necessary hydrogen content, results in the throwing down of too much free carbon. It is necessary, therefore, to modify the action of steam in reducing this by the use of suitable catalysts. Questions of heat to be supplied, if any, in reforming rich oil and gases and the use of oxygen are discussed.

Summarised: The production of gases of group 1 (town gas) is characterised by, the excess of carbon in petroleum derivatives, the essential rôle of the catalyst, the amount of added heat generally necessary.

Part 2 of the paper describes briefly the several methods and processes in use or in course of development in France.

Processes, called "autothermic," requiring no addition of external heat are:

(A) GASIFICATION IN AIR/STEAM

(1) For the 'reforming' of natural gas or propane, a mixture of air and methane or propane in appropriate proportions is injected into a contact bed consisting of grains of alumina or alumina with nickel (for natural gas 2.5%). The reformed gas obtained has, for example, with propane without steam, some such composition as: CO_2 3%, CO 19%, H_2 24%, CH_4 4%. N_2 50%. The calorific value is 1,600 cal/m³ and the gas is enriched with pure propane. The hydrogen content can be brought to nearly 30% by heating the air and by the use of steam.

These processes are extremely simple and cheap, giving a gas which, while not a perfect substitute for town gas, is at the limit of utilisation in most French burners designed for town gas after regulation of air. These processes, with propane, have been used in undertakings where it was not desirable to change the burners, yet where it was desirable to produce additional gas to meet peak loads. Its relatively high hydrogen content permits the addition of a high proportion for the latter purpose (as much as 50/50). The advantage of this arrangement is that it permits considerable flexibility in output of gas whilst, at the same time, avoiding too great a problem with the combustion characteristics of the appliances.

(2) Oil Gas—The G.E.I.M. Producer Process.

The producer is based on the Dayton-Faber process and is referred to in 'Gas in France' (November 26, 1952, p. 501 and November 24, 1948, p. 443). It produces a gas with the necessary calorific value (say 4,200 cal/m³) but containing very little hydrogen (5 to 6%) with difficulties in utilisation. Some attempts at improvement by preheating the air and steam have only given four or five points more of hydrogen.

(3) Producer using Fuel-Oil and Tar (O.C.C.R.)

This apparatus is in service heating settings (see drawing and brief description in the GAS JOURNAL (September 2, 1953, p. 589).

The liquid fuel is injected tangentially into a cylindrical vessel. The product is a producer gas (1,000/1,100 cal/m³). The carbon, in spite of the considerable turbulence, is incompletely gasified, but it is taken forward to the retort setting at a high temperature (1,250°C.) and there contributes to the heating. The thermal efficiency, with this sensible heat and the heat content of the suspended carbon, is of the order of 95% provided that the producer is built immediately adjacent to the setting, thus avoiding the loss of sensible heat.

(B) GASIFICATION IN PURE OXYGEN AND STEAM

A pilot apparatus by Panindco (Cie. Pan-Europeene d'Installations et d'Equipments Industriels) has been recently, (July, 1953) put into operation at Rouen, gasifying heavy oil with oxygen and steam to obtain autothermically a town gas with the normal calorific value and hydrogen content.

Endothermic Processes—*i.e.*, requiring the addition of heat are:—

(A). Those with preheat of injected fluids. It is not often possible to pre-heat above 3/400°C. a mixture of air and hydrocarbons without premature combustion with the abundant formation of black smoke.

(B). External Heating.

The nature of the wall through which heat is to be transmitted limits the temperature.

The heating surface increases much slower than the capacity of the containing vessel, which is (say) cylindrical, and can only be adequately heated if the diameter is small. Therefore one must use either many tubes of small djameter heated in a furnace or a large reactor heated by fire-tubes. The reforming of natural gas, propane and butane in the presence of steam and possibly a little air, is current practice.

In France, there are the following types of process in use:

Reforming of natural gas and propane (Hercules Powder process) using as reactors, tubes in special steel and the Starck process, under construction, and reforming refinery gas (Gas Machinery Co. process) using tubes in carborundum, also under construction.

The gasification of heavy oils is much more difficult, but cracking of gas-oil in gas retorts of all types has been practised since the war, with the object of meeting the shortage of coal and increasing the output of retort plant. The production of a gas-calorie from gas-oil requires less heat than that of coal-gas practice. Mixed with the latter the high calorific value of the oil-gas and its low hydrogen content passes unnoticed in day-to-day working.

(C.) Electrical Heating.

Nothing has been done in this direction in France.

(D.) Cyclic Processes.

The authors describe the ONIA-GEGI and the Hall proceses. The former was described by Robertson and Harrison in a paper reported in the JOURNAL of September 23, 1953, p. 770.

Discussing the results obtained in the former plant at Cahors the authors say:—The gas obtained from heavy oil has a satisfactory similarity with the classic town gas. The action of the catalyser, which plays a very important part in the process, results in the production of a tar of acceptable quality which can be used in supplying heat to the apparatus, but especially in the disappearance of deposits of ungasified carbon. The small naphthalene content is easily dealt with.

An examination of the gas obtained shows that it consists of a high proportion of water-gas (61.6%), a little, pretty rich 'cracked gas' (30.2% at 8,300 cal/m³=870 B.Th.U/cu.ft.) and inerts (8.2%). Former plants for the cracking of oil on hot chequer brickwork supplied a gas with a higher proportion of 'cracked gas' at 7,400 cal/m³ (58%), water-gas 35% and inerts 7%.

It is evident that the catalyst slows down the cracking and favours the gasification of the carbon by the steam. From the practical point of view, it follows that this process seems particularly adapted to oils with a high carbon content and moderately so to cracking, that is to the cheaper residues. It is the use of the catalyst which confers upon the process its originality. The cost of the apparatus and the complexity of its operation render it inadvisable for quite small works; the authors are of the opinion that, except in particular cases, its use should be reserved for outputs in excess of 20,000 m³ (say 700,000 cu.ft.) per day.

(E). Moving Beds. The use of these processes by Gaz de France for the production of oil-gas has not passed the stage of laboratory tests and consecutive studies of pilot installations. It is possible that one of them will soon be tried out on the scale of a pilot installation in France.

Judge Criticises New Gas Cleaning Plant

Awarding damages to the widow of a man who was killed by carbon monoxide from discharge pipes inside the water control room of a new gas cleaning plant at Hawarden Bridge Steelworks, Mr. Justice Austin Jones, at Chester Assizes on November 1, said if the firm, John Summers and Sons, Ltd., had relied less on the designers of the plant, they would probably have realised the danger.

The defendant company did so after the death of Mr. William Walsh (56), when they placed the pipes outside, said the Judge.

'It seems to me the designers should have foreseen this danger, and possibly the erectors, and the person who supervised the erection,' the Judge said. He awarded damages of £1,080, with costs, to the widow, Mrs. Bridget Walsh, whose husband was an attendant in the water control room at the time of the accident, March 23, 1953, a few weeks after the plant had been opened.

She claimed damages for alleged negligence and/or breach of statutory duty.

For the plaintiff, Mr. W. L. Mars Jones alleged that pipes inside the room which discharged water into a drain would at a certain stage in a particular operation begin to discharge a combination of water and gas, and finally pure gas, unless the valves were turned off.

The Judge said the plant, the first of its kind to be erected in this country, was designed by the Research Corporation of America, and built by Head Wrightson and Co., Ltd.

He said the defendants could not be expected to do more than employ persons who were apparently competent to design and erect the plant, and he found therefore that allegations against them, the defendant company, of negligence in the designing and erection of the plant were not made out.

The Factories Act, however, applied to the premises, and the most effective precaution of placing the pipes outside had not been taken at the time of the accident. It could not therefore be said that defendants had taken all practical measures to protect persons employed in the chamber from inhalation of the gas.

The Judge said he was satisfied that Mr. Walsh received sufficient warning as to the danger that would arise if the valves were not closed when the flow of water ceased, and he found that Mr. Walsh was fully and adequately instructed as to his duties. The ventilation, said the Judge, was adequate, and he did not consider there was need for a warning instrument as the 'splutter' which occurred before the flow of water ceased should have been sufficient warning.

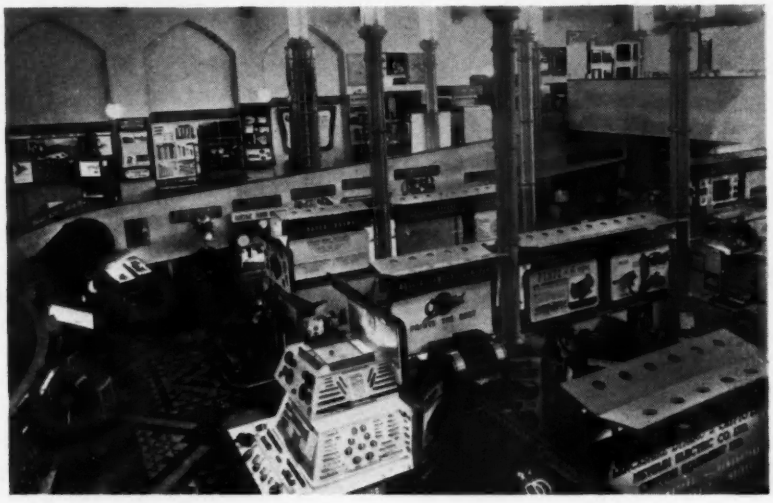
The Judge found that the man's death was caused by his own negligence in not closing the valves. Mrs. Walsh, he said, was not entitled to succeed on the issue of negligence, but did so on a breach of statutory duty on the part of defendants. The damages must therefore be reduced by half in view of Mr. Walsh's own negligence. The Judge apportioned £75 of the damages to a 14 years old son, one of five children.

NORTH EASTERN STAFF CONFERENCE

One of the most enjoyable events at the third biennial staff conference of the North Eastern Gas Board at Harrogate was the reception and dance at the Lounge Hall, at which this photograph was taken. It shows Dr. R. S. Edwards (Chairman of the Board), with Mrs. G. E. Currier, Councillor A. V. Milton (a former Mayor of Harrogate who deputised for the Mayor in receiving the guests), Mrs. Edwards, Mr. G. E. Currier (Deputy Chairman of the Board), and Mrs. Milton.

Permanent Engineering Exhibition Centre

Opened in June of this year, the Birmingham Exchange and Engineering Centre is attracting a steady flow of visitors and the organisers must be satisfied with the progress made. Well aware of the need in the Midlands for an organisation which would allow manufacturers in the engineering and allied industries to display their products on a permanent basis, and enable engineers, whether buyers or manufacturers, to keep abreast of the latest developments in their industry, members of the Birmingham Exchange decided to vote over £25,000 of their funds to the financing of this project. History records that the Exchange was founded in 1861 'to promote the commerce and manufactures of Birmingham and its neighbourhood.' Members of the Exchange today are still very conscious of its aims and objects.



General view of the Birmingham Exchange Engineering Centre permanent exhibition.

It was originally intended that local firms only would have the opportunity to display, but this conception was expanded to include firms from all over the country. The decision to open such a centre caused considerable interest in all branches of the engineering industry and over 200 manufacturers have taken space to display their products.

The West Midlands Gas Board, which services the largest industrial load of any area board in the country, recognising its responsibility and on the recommendations of the Industrial Department, decided to take a prominent place in the exhibition. With the co-operation and expert assistance of the Board's Publicity Department a display stand was erected. The stand, elegant in its simplicity, has in the background three transparencies, model of a continuous paint spraying and drying plant for steel drums. On the other side is a model of a refractory roller hearth conveyor furnace for bright annealing of ferrous and non-ferrous metals, vitreous enamelling and other such work. The two models, which are beautifully made, are on loan from the Incandescent Heat Co., Ltd., of Smethwick. It is the intention of the Board's Industrial Department that the models and photographs be changed regularly and other manufacturers will be invited to loan suitable models.

West Midlands Gas Board stand at the Engineering Centre exhibition.

the centre one featuring the Swan Village works. In the centre is a prototype low pressure natural draught gas fired furnace for melting aluminium. This was designed to meet the requirements of a local school. On the left of this is a

In a neat brochure, which visitors to the exhibition can receive, full details of the facilities available to industrial users of town gas are given.

In the past 12 months the Industrial Gas Department has dealt satisfactorily with enquiries for the conversion of a pit core drying stove from oil to gas firing, the curing of shell moulds, and the heating of melting pots integral with diecasting machines; the heating of non-ferrous billets for extrusion, continuous wire galvanising and external heaters for drying stoves, the edge fusion of glass bricks and the conversion of large steel forging furnaces from pulverised coal to gas firing. Another process now returning to favour is the running in of motor car engines on town gas instead of petrol.

The function of the Engineering Centre, in addition to maintaining the permanent exhibition as a rendezvous for all interested in engineering, is to handle engineering enquiries, and to become a recognised source of up-to-date information relating to engineering productions, sources of supply, sub-contracting work, and local representation. An extensive information department has been established and enquiries are passed to the appropriate exhibitors, although information relating to other manufacturers will be submitted if requested. Other facilities include an exhibition hall specially designed for private short-term exhibitions, lecture rooms for film projection, for trade and technical associations and exhibiting firms; private offices, with secretarial and telephone services for visiting executives; and a coffee room, situated on the balcony, where more than 100 technical periodicals covering all fields of engineering are to be found.

THE Publicity Committee of the Association of British Chemical Manufacturers has recommended, and the Council of the organisation has approved that the chemical industry become re-associated with the British Industries Fair in London.

...and now the

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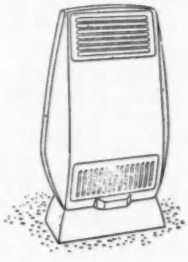
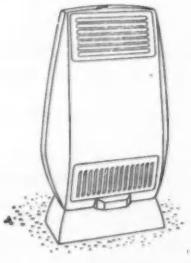
The NEW WORLD MERLIN 378, like its predecessor, is a free standing flueless heater designed for use in halls, on landings and in suitably ventilated rooms. It has a handle and is easily carried from room to room, but it also can be fixed to the floor if desired.





The new design includes removable vitreous enamelled grilles which give a more handsome appearance and which make cleaning easier. A new feature provides for controlled dilution of the hot gases with air before they leave the heater, so avoiding extremes of temperature. Although the nominal rating remains unchanged at 6,000 B.Th.U./Hr., this new model is much more effective.

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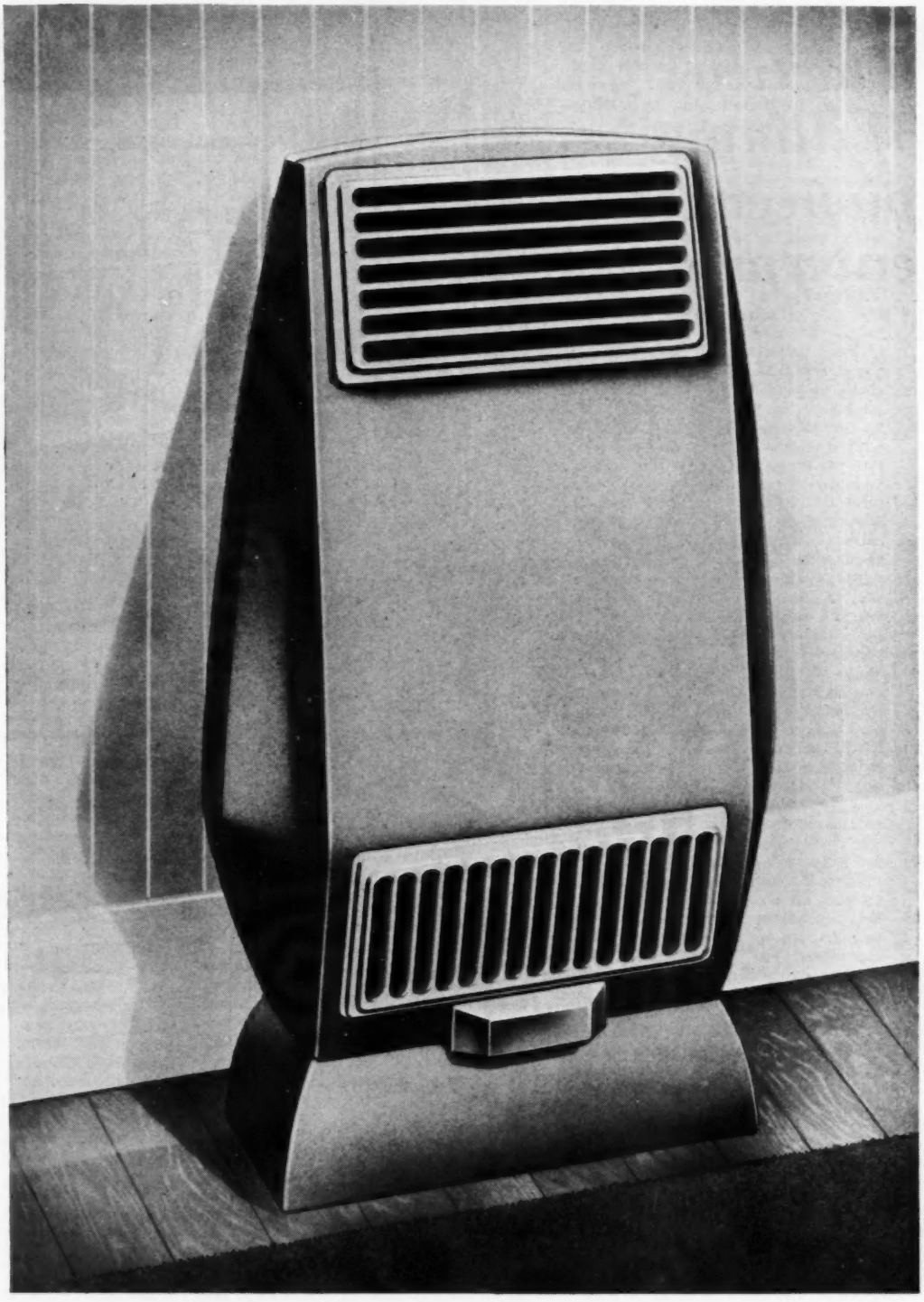

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When William Murdock illuminated his home by gas in 1792, William Flavel was only 13 years of age. With gas illumination Murdock revolutionised lighting and later, Flavel was to revolutionise cooking by inventing his Patent Kitchener.

These great men contributed in no small measure to the development of the gas industry. Flavels have maintained their pioneering spirit and today they lead the field. The housewife knows that the Flavel '68' makes the most of gas.

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NORTH EASTERN STAFF CONFERENCE

Review of Discussion Panels at Harrogate

LAST week (pp. 409-411) we reported the principal speeches at the third biennial staff conference of the North Eastern Gas Board at Harrogate from October 27 to 29. We now report the reviews presented by the chairmen of the seven discussion panels at the two plenary meetings—four on the Thursday and three on the Friday.

DR. R. S. EDWARDS, in opening the plenary session on the Thursday, welcomed Mr. Owen Francis, Under-Secretary, Gas Division, Ministry of Fuel and Power, Mr. F. G. Brewer, Secretary of the Gas Council, and Brigadier Kenneth Hargreaves.

The Domestic Load

ALDERMAN H. SUTCLIFFE, reporting on the 'Domestic Gas Sales' panel, said the subject was far too wide to be confined to a two hours' discussion. Mr. Hudson had foreseen that, and in his paper he had suggested seven questions with a view to determining whether, firstly, full advantage was being taken and the best use made of existing sales services provided by the Board to increase the sales of those particular appliances connected with those loads; and secondly, whether there were any serious weaknesses in their competitive position *vis-à-vis* other fuels as far as those appliances were concerned.

'Is too large a proportion of our advertising and that of our manufacturers devoted to cooking equipment?' The general opinion was that since the cooking and home laundry loads were being seriously attacked by their electrical competitors the existing promotional advertising of the gas appliances sold for those household services should not be reduced, and that if the sales of domestic appliances other than these were to be increased, promotional advertising additional to that now being done should be undertaken in order to stimulate sales.

'Are too many of our showrooms overcrowded with cookers and washing machines to the almost complete exclusion of other appliances?' The opinion was that although such a condition might apply to certain showrooms the showroom personnel were often in a difficulty because of limited space. It was, however, generally agreed that an effort should be made to allocate some space for the proper display of other appliances.

'Is there a lack of both attractive displays for these other appliances and of the "know how" of using them to best advantage?' It was agreed that these two conditions applied, and a suggestion was put forward and approved that arrangements should be made for a larger production of suitable displays and further that staff should be made available who were properly trained in display, sufficient to ensure that all the Board's showrooms should be adequately covered.

'Are some of our showrooms unattractive, with dusty exhibits and dirty windows?' Although it was agreed that such conditions would only exist to a limited extent, it was accepted that showroom attendants themselves should be held responsible for the maintenance of showrooms and their contents in a clean and presentable condition.

'Are the prices of "those other" appliances too high?' It was generally accepted that particularly when compared with electrical appliances of equivalent design and capacity, the price of these appliances was competitive, and it was further agreed that every effort should be made to sell the higher priced appliances the service value of which was deemed to be sufficiently high to offset a higher initial appliance cost. It was felt that salesmen might with advantage in the case of these higher priced appliances, sell the 'service value' of a particular appliance first before selling the actual appliance.

Installation Charges

'Are installation charges too high?' Compared with other domestic services it was felt that the Board's installation charges were not too high, but that every endeavour should be made to reduce them on the lines of the recent development for installing water heaters —*i.e.*, by using fittings specially designed for one particular job, and by developing prefabricated installation materials which would allow the Board to buy in bulk and therefore at lower prices than was the case today. It was also agreed to support a suggestion made by the Chief Commercial Officer that a study be made of the practicability of allowing a rebate on installation charges when two or more appliances were fixed at the same time in one dwelling, it being felt that in such cases there was an actual saving to the Board which if passed on to the consumerc could assist in effecting additional sales. An expression was recorded that the meeting hoped that the Board's present policy of being satisfied if the income from installations covered the bare cost to the Board of carrying them out would not be changed and further, that if any economies were made on the lines indicated they would be passed on to the consumer.

'Is the price of gas too high?' The fact that gas at the prices charged under the existing tariff was competitive with other fuels for short period space heating, intermittent supply of small quantities of hot water and for refrigeration was generally accepted, though reluctantly by some. A suggestion, however, was made that as and when any review of the present tariff was made an attempt should be made to provide a design of tariff which was definitely promotional for the sales of gas for space heating and hot water supplies in domestic premises.

The panel submitted two supplementary recommendations on points which had a bearing on most of the problems discussed, and were concerned with the appointment and training of salesmen and staffing showrooms. It was generally agreed that the Board should consider the appointment of trained salesmen of proved ability from outside the industry and further consider taking steps which would ensure that men transferred from other activities within the Board to the appliance selling side should be properly trained as salesmen; and that the problem of staffing small showrooms where generally only one person was in attendance should be examined, and, if practicable, steps be taken to ensure that the sales service was not unduly subordinated to other needs.

There was a danger of becoming infatuated with large increases in the sales of appliances. It had been pointed out that the sale of a gas cooker was very often a replacement and because of its higher efficiency it resulted in a reduced gas load in respect of that appliance. If the proportion of gas cookers remained unduly high it would seem to be almost suicidal that extra attention should be given to the sale of gas cookers. Sociological conditions changed and if a cooker of higher efficiency was sold as a replacement it inevitably meant a reduced gas consumption. He would like to see a showroom manager present a report showing the possibilities of maintaining sales in the aggregate, with a greater proportion of higher priced appliances which might result in a higher gas consumption. There was a tremendous field in that direction.

The panel had not time to pursue the question of market research. Was sufficient attention given to the individual after an appliance was sold? Was there any system of follow-up to see that an appliance was giving satisfaction, and was the consumption of gas ever checked to see whether the new appliances resulted in an increase or a decrease? It was essential to use every possible means of getting into the consumer's dwelling house, for it was there that they had a chance of making suggestions about new applications for gas. It was necessary that the Board should pursue an imaginative sales policy and be able to recruit the right staff to carry it out.

Industrial Gas Sales

MR. W. R. TODD, reporting on the panel dealing with industrial gas sales, said Dr. Edwards, Chairman of the Board, had told them that the increase in industrial gas sales was really a success story, and that that increase in sales had in fact materially helped the Board to maintain the present prices for gas and to avoid any further increases. The Chairman had also invited opinion on the value of introducing a special industrial tariff, the question of extending and reorganising the industrial tariff,

and whether improved consumer service in all its aspects was the real answer and the best method of increasing the rate of expansion of industrial gas sales. The panel considered that improved consumer service in all its aspects was the best means of increasing the rate of expansion of industrial gas sales.

The discussion centred around two main points—the question of tariff, what the industrial consumer was charged, and the question of increasing or reorganising (or both) the staff dealing with industrial business. One speaker had said that it would be well worth while for the Gas Council to set up a skilled library staff in order to produce a review or prècis of all that had been said and published about industrial gas throughout the world. He understood that something of the kind had been done by the Coal Tar Research Association and also by some American organisations which sent out a publication usually too voluminous for our busy managers to read.

No one had expressed an opinion that a special industrial tariff should be instituted. On the whole approval was given by the panel to the form of tariff which now existed. Generally speaking, it was thought that any alteration in the direction of a special tariff would probably raise more difficulties than it would solve problems. There was some criticism of zoning, and the point was registered that the practice of zoning for tariff purposes was unfair from an industrial consumer aspect, as firms producing identical goods in York and in Spenborough were obviously selling in the same market and yet were paying different prices for gas for heating their plant.

It had been generally agreed that the industrial activities of the Board would benefit from more staff, that the potential was there, and that the harvest could only be reaped properly if the staff was increased. It was realised that the present staff and any increased staff they might get, had two quite different jobs to do. One was to look after the plant that now existed, to provide continual and efficient expert service to existing consumers; the other was to seek new business, a large, difficult, and complicated question. The staff should always be in the position to provide a fully documented presentation of comparative costs and be able to put forward all the possible advantages of gas. There were some loads that they could not get and they might well not spend too much time worrying about them.

Coke : The Challenge

BRIGADIER K. HARGREAVES, reporting on the coke panel, said a good point was made by a member, who suggested that they should not talk just about coke but should talk persistently about gas coke —a suggestion that was well received. There was a little uneasiness about spending money on technical advice for coke customers, and it was pointed out that there were more ways than one of selling an article, and that technical advice might well be one of those ways. The panel agreed that the coke marketing scheme was good and had much in it to help the industry.

There was agreement about improving showrooms and giving coke a better show and more space and prominence, and there was a suggestion that the Board should give some concession in price to members of the staff who used coke in their homes. A member of the panel suggested that they should issue a challenge to the merchants. Another said they wanted their co-operation, and one thing he particularly appreciated was Mr. Wilson's insistence on the improvement of co-operation with the distributive trade as being brothers in arms. Such co-operation could not fail to help in pushing up sales of gas coke, and he knew members of the trade would particularly welcome the suggestion about instructional meetings and the establishment of coke salesmen's circles in which they could get down to the problems of pushing the sales of gas coke.

The panel had talked about propaganda, and it was instanced that 'Mr. Therm' had done a lot of good for the gas industry, and that it would be worth while to spend money on gas coke propaganda to popularise the idea with the customer. It was suggested that apart from newspaper Press publicity a great deal of good could be done with well drawn up leaflets sent out with bills and given to the merchants for distribution. It was also suggested that there was considerable value in practical research—in getting members of the staff and their customers to make experiments with grates, whether industrial or domestic, to see what could be done to improve the grate or to improve the fuel in order to get better results.

Joint Consultation

MR. J. W. FISHER, reporting on the joint consultation panel, said it was appreciated that the Gas Act laid down that consultative committees should be established to deal with safety, health and welfare, etc. Both sides of the industry had a responsibility to establish understanding and co-operation, and if there was not a desire already for joint consultation then there should be one. The industry being a public service, the best use of it had to be made for the service of the public and there could only be got out of the industry what both sides put into it. The feeling of the panel was that there was a definite desire in the gas industry for proper joint consultation.

The next point was whether the management and workpeople representatives were applying the right spirit in their deliberations. It was appreciated that in joint consultation the industry was only in its infancy as the committees had only been running for two and a half years, and it was agreed that there was still a lot to learn on both sides. Opinions were expressed on the spirit of joint consultation, and the majority felt that the right spirit was growing, and many instances were quoted where there was better feeling and understanding developing. The panel went on to discuss the question of the problems created by the fusion of many small works into one group, and the method of setting up consultative committees. One of the main problems arising from the arrangement whereby one representative was drawn from a group of small undertakings was the dissemination of information to employees as to what had been discussed at joint consultative committee meetings. Concern was felt for the smaller works as only one representative covered three or four small works, and it was realised that in all probability the decisions and the work of the committees were not getting to the workpeople at those small works. It was revealed, however, from the experience of some representatives that the employees in the smaller works were more conversant with the work of the committees than those in the larger works because they took the trouble to read the minutes which were circulated, whereas in the larger works, with only one copy of the minutes on a notice board, it was not always possible for all employees to find time to read them. It was rather revealing to learn that representatives covering the smaller works did in fact contact the works and proffered to attend any meeting which the employees wished to arrange.

A further useful suggestion was brought out whereby minutes of the committees should not only be posted on notice boards, but extra copies should be allowed to circulate among the workpeople in the messrooms, or by circulation of a copy to individuals not only in the works but in outside gangs who rarely had the opportunity of partaking of a meal in the canteen. It was felt that delegates who represented small works should accept the responsibility of preparing a report instead of depending on the information given in the minutes which did not in themselves convey the full discussion in relation to the decisions reached.

The panel next considered whether it was necessary to have separate committees for staff and industrial employees. The opinion was that in view of the fact that points discussed by staff and industrial employees were not comparable, much valuable time could be lost in discussing those points and it was agreed that a useful purpose could be served if a joint conference could be held once or twice a year when points of mutual interest could be discussed.

Gas Production

MR. C. A. NEWHAM, reporting on the panel dealing with economy and efficiency in gas production, said the paper served a useful purpose in helping to clarify the impression of economy in respect of integration. Mr. Barker showed the relative costs of different sizes of undertakings which in itself gave an indication that integration was a profitable thing. One speaker made a point that the relative cost of transport of coal into a certain works was higher than formerly. He estimated that his cost of coal per therm could be reduced by 8% by employing means of transport other than that at present used. Here again, said Mr. Newham, it was stressed that there had been a substantial saving since vesting day by a complete

review of coal allocations in relation to their source and destination.

Regarding load factor, Mr. Newham said it was agreed in respect of retorts that in the past an excessive amount of standby plant was often employed and there was also general agreement that a saving in cost could be made if more attention were given to working gas plant, particularly vertical retorts, in excess of their nominal rating. A figure of up to 10% above nominal was regarded as reasonable. Attention was drawn to the economies to be gained by a close scrutiny of the scurfing programme which should conform more closely with varying gas demand even at the expense of strict scurfing rotation. It was pointed out that this should only be applied within limits. This was done in some places where scurfing was undertaken at week-ends. The full use of gas plant was important early in the week. This, he felt, was a very good point. There were works which could follow this procedure but were not doing so.

Fuel Expenditure Index

On the Fuel Expenditure Index, Mr. Newham said that a speaker had raised a point that he felt the need for a formula whereby true assessment of economics of gas making plant could be obtained. It was generally agreed that on the average considerable saving could be made if closer attention was given to retort house practice, particularly in relation to coke consumption. This, said Mr. Newham, he felt was the main point as a result of the paper in respect of suggestions. A suggestion was made of the possible advantage to be derived from an automatic coke weighing device for fuel to producers.

He thought, in general, a works manager did not know what had gone into his producers until the end of the week or some period when he could assess his stocks. In some cases where large stocks of coke were involved he had to estimate and continue to estimate over a long period until the stock was such that he could get a true comparison.

Purification

With regard to purification, a plan was made for additional mechanisation. An important point, in his opinion, was in the training of new retort house personnel. Such training was usually undertaken by the regular stokers. This often interfered with routine operation and in consequence efficiency was affected. It was suggested that the new personnel should be properly instructed by some responsible employee. On benzole recovery some doubt was expressed as to whether recovery in certain instances was an economic proposition. It was generally agreed that it was a complex problem, and each individual case should be treated on its merits. There was an enquiry as to whether it would not be an advantage to resort to recification of benzole. Difficulties of running a small works efficiently, in a thermal sense were discussed, and most problems appeared to be well-known and appreciated. The suggestion was put forward that in certain cases employment of butane gas might be advantageous, particularly, and further exploration to this end should be considered. Attention was drawn to the improvement shown in the national returns of the thermal efficiency of the gas industry. A figure rising from 71.2% in 1948 to 75.4% in 1953-54 was quoted. In this connection, said Mr. Newham, stress was made that even a small reduction in the cost of gas production could be most vital, affecting sales particularly, and that large loads could be lost or gained on a margin of a fraction of a penny. It was suggested that further investigation might profitably be carried out in studying alternative methods of gas purification. A speaker wondered whether it might be possible to eliminate scurfing of retorts and increase the efficiency of the gas-making plant.

The Trade Union Approach

MR. G. HOOD, giving the views of the panel on the trade union approach to industrial relations, said one member summarised the feelings of many when he said that the subject was of such interest and importance that he would have liked all the panels to have been merged into one to discuss the subject in open forum. The Board might sell more coke, increase sales of gas, boost gas appliances, undertake research and effect economies, but all the efforts could be nullified by one slight error in industrial relations resulting in the withdrawal of labour involving thousands. Mr. Matthews had attempted to be provocative. He had advanced views the intention of which was to stimulate discussion, and in that he was very successful. The main thought was that trade unionists should be given a greater say in management, not by usurping the functions of management, but by greater consultation.

No Direct Representation

Referring to representation on national boards, Mr. Hood said they were all fairly well agreed that trade unionists should not have direct representation. Some said it would be impossible and that the primary function of a trade union was to safeguard members' interests. If they took part in management they would have divided loyalties and could not satisfy either satisfactorily.

The panel was by no means unanimous and many differing opinions were expressed on the part trade unionists could play in the management of industry. Those who favoured a greater say for trade unionists in management contended that employees should have the right to express opinions. One member contended that a man was not only selling his labour but was devoting his life to the industry, and therefore should have some say in how his life should be used. On the question of layout of buildings, one member suggested that employees could give a big help in the construction of new plants because they were the people who worked in the building and knew the snags. In the electricity industry they had a different set-up for consulting machinery. They had a District Joint Advisory Council, and the practice there was that plans for alterations of buildings were submitted to that council for consideration and in that way views were obtained by the board. Mr. Currier explained what the practice was with their Board and said that consultation did go down to district level. Of those opposing the suggestion that trade unionists should have a greater say in their industry, one said trade unionists should not attempt to interfere in management and could not assist management as employees, apart from those at higher levels, had insufficient knowledge for their assistance to be of any value.

The panel generally agreed that there should be as much consultation as possible between the Board and the employee. Here he would like to hand out a bouquet. Their Board invariably fulfilled its obligations as far as consultation was concerned. That conference was an example of the way the Board tried to put over its view to the employees.

Management Accounting

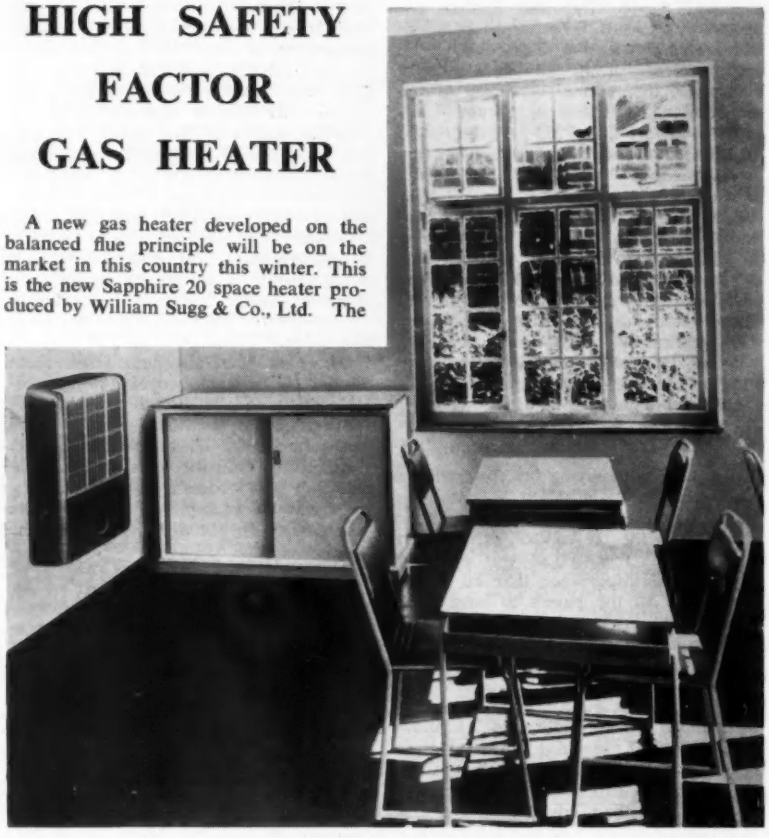
MR. R. WALTON reviewed the proceedings of the panel on management accounting and budgetary control and said that in the discussion it was brought out that management accounting was a system which should be a tool for management and not just a toy for the accountant. The North Eastern Gas Board was, he thought, ahead of most boards in management accounting. It was brought out that Bournemouth had adopted management accounting and budgetary control and one member said that many hidden differences, which before had been unknown, were now revealed. One member thought that sales should be the next operation to be subjected to this scrutiny. One member thought that because he was short of fitters and they were fully employed there could not be any unproductive time and it was pointed out that full employment did not eliminate inefficient working.

An Added Tool

Management control was not meant to supersede managements functions in any way. It was merely an added tool. One man mentioned the saving of 17% which could have been made in fitters' time. He thought the panel appreciated they were beginning a deeper search into their own weaknesses to obtain a more efficient method of conducting their business. He wanted to pay tribute to Mr. Allum and his staff for starting this difficult project. Mr. Walton said he had had the opportunity to discuss the subject with many great industries and they were all feeling their way as to how they should apply this method and he thought that the North Eastern Gas Board had got off to an extremely good start. The grasp which the panel had of its subject was gratifying and he looked to the North Eastern Gas Board to improve its efficiency and method over the next few years by the steady improvement of management accounting.

HIGH SAFETY FACTOR GAS HEATER

A new gas heater developed on the balanced flue principle will be on the market in this country this winter. This is the new Sapphire 20 space heater produced by William Sugg & Co., Ltd. The new Sapphire can be fittted in factories, offices, halls, or rooms of flats and houses and is perfectly safe for use in a children's nursery.



The new Sapphire 20 balanced flue space heater, installed in a children's schoolroom. The heater is produced by William Sugg and Co., Ltd.

One of the outstanding features of the balanced flue type of gas heater is that it does not allow any of the harmful products of combustion to enter the room in which it is fitted. Gas fire designers have for many years sought to overcome the problem of the sulphur content of gas to produce a heater that would combine a high standard of efficiency with maximum safety.

With the balanced flue system, air for combustion is drawn into the heater from outside the room, circulated round the combustion chamber and then passed back into the open air. The heat is thus retained without any of the injurious flue gases, and the new Sapphire maintains a high efficiency when compared with other types of gas fires today on the market and the coal fire which has a high degree of chimney loss.

Air from the room is drawn into the base of the heater and warmed as it passes over the hot combustion chamber before being discharged through the grille of the outer casing and this convection process ensures a constant circulation of warmed air throughout the room. None of this air comes into direct contact with the gas burner. The heat of the new Sapphire can be regulated, and this heater will warm a room of approximately 1,600 cu.ft. at a comfortable temperature at a cost of about 2d. an hour. The heater has a permanent pilot jet for lighting the main burner. A safety device prevents the gas from the main supply from leaking into the heater when it is not in use.

The new Sapphire is simple to install and is fixed by four bolts set into the wall. It is 34 in. high and 26½ in. wide and projects only 7¼ in. from the wall. The balanced flue is no larger than the cross section of a standard brick. The duct for the incoming air surrounds the flueway and is protected by a terminal which projects less than 2 in. from the surface of the wall outside the building. The Sapphire 20 is finished in a golden bronze stoved enamel, although it can be supplied in other colours. It can be obtained through gas boards and showrooms or direct from manufacturers, William Sugg & Co., Ltd., Vincent Works, Regency Street, London, S.W.1.

Scottish Gas Board Headquarters at Edinburgh report that 88% more washing machines were sold between April and August this year than in the previous five months. This is all the more remarkable since restrictions on hire purchase were not lifted until July 14. These greater sales seem to bear out the theory that more people decided to spend their money on equipment for the home instead of holidays. But refrigerator sales did not rise.

Price of Gas at Coleraine

Coleraine Borough Council decided at a special meeting not to increase the price of gas to consumers, subject to the Government granting the Gas Department a loan of £15,000 with which to pay off a bank overdraft. The Council's auditors reported that there had been a net working loss of £1,400 on the gas undertaking for the year ended March 31, 1954, as compared with a net working profit of £3,314 in the previous year. To the loss of £1,400 was to be added £750 in respect of estimated additional income tax, making a net deficit for the year of £2,150.

The recommendation that the Council should apply to the Ministry for a loan was made by the Clerk (Mr. W. E. Henry, M.B.E.) who pointed out, however, that if wages and the cost of coal and freight continued on the upward trend then the price of gas would have to be increased.

The report of the auditors stated that income from the sale of gas and residuals for the year was £68,957, £3,985 less than the income for 1952-53. Against this the cost of manufacture of gas declined by £3,142 to £49,151 in the year under review.

The report showed a reduction in gas consumption from 150,057,700 cu.ft. to 140,351,330 cu.ft.

When Councillor J. R. Patterson asked for an explanation of the decrease in consumption the Gas Manager (Mr. W. R. Armstrong) stated that the drop was due to a milder winter, but consumption was going up again.

The Clerk said there had been a consistent loss in public lighting which had now reached £2,000 a year—a loss which could have been cut by the ratepayers paying for their public lighting or the gas consumers paying more for their gas. It was clear that the Gas Department could not continue to stand a loss of £2,000 a year. The price of gas had not been increased during the years 1941-48 in conjunction with the increase in the price of coal and wages and the general rise in costs. The result was that the gas consumers who had benefited by gas not being increased were now going to suffer for the resultant loss.

The Gas Department would not get the benefit of the saving on public lighting this year, and there would only be a partial benefit the following year. (The Council has agreed to proceed with a £36,000 electric street lighting scheme which is expected to be in operation for the winter of 1955-56).

The Clerk recommended that the Council ask the Government for a loan of £15,000 on the understanding that it would be repaid before March 31, 1960, and so avoid an increase in the price of gas. This was agreed to.

THE Ruhrgas A.-G. is storing 11 mill. cubic metres of coke-oven gas underground in the Engelbosteler Sattel limestone structure north of Hanover. The method is based on U.S. experience with natural gas storage.

Gas and Electricity Link-up

An unusual event took place when products of the electrical industry were featured in a lecture at a Cheshire Gas Centre. Putting aside all thoughts of competition between the two industries the North Western Gas Board invited Mr. L. R. Prout, Director in charge of Research and Development at Oldham & Son, Ltd., to give a practical lecture on 'Oldham Batteries and their World Markets.'

The idea of a talk on electrical products at a Gas Centre is, however, not nearly so strange as it might seem. The two industries have many common meeting grounds, and as Mr. Prout said at Hyde, 'There is a very real lesson behind this apparent anomaly.

'In industry these days, life is so complex that not one of us can even hope to be self-sufficient, but all lean one on the other. And so it is with us. Gas is of paramount importance to many phases of our battery production, and without its aid we should find it hard to produce packaged electricity at an economical cost and to a necessarily high standard.'

A Hereford Protest

A letter from Hereford Chamber of Commerce protesting against the Council's plan to supply council house tenants with electric refrigerators on a five or ten year basis, with free installation, was read by the Town Clerk, Mr. T. B. Feltham, at a meeting of the Hereford City Council.

The letter stated that it had been brought to the notice of the Chamber that the Council, through its Treasurer, had sent out a circular letter to its council house tenants offering to supply electric refrigerators on a five or ten year basis with free installation. The Chamber objected to this form of municipal trading which was to be deprecated as it struck at the roots of the private traders' livelihood.

It was understood that no approach had been made to any local trader for the supply through them or for the installation of these refrigerators, which should and could have been done.

Alderman Pigot said they had made enquiries about the present prices quoted to housewives and had discovered that the minimum deposit was 10% against the maximum time for re-payment of two years. This meant a weekly payment of 12s. which tenants had said they could not afford. He added that the rate of interest to be charged on the balance was 12½% which also the tenants could not afford.

Alderman Pigot hoped they would support a resolution giving the tenants the choice between gas and electricity, which the West Midlands Gas Board was offering.

It was resolved that the West Midlands Gas Board be invited to submit a quotation for the supply of gas-operated refrigerators, and that tenants be allowed a free choice of electric or gas refrigerators.

GAS AT TRADE FAIR

Mr. H. Maycock, Engineer and Manager of the Holywell and Flint undertaking of the Wales Gas Board, and Organising Secretary for the Flint Chamber of Trade, was successful in having his proposals accepted for a Trade Fair in the Borough of Flint, which was formally opened by the Mayoress of Flint, Mrs. C. Godfrey.

Part of the gas stand at the Trade Fair organised by the Flint Chamber of Trade.

Many difficulties had to be overcome in obtaining suitable accommodation, and it was pleasing to note that the Flint traders must have exceeded even their own expectations, for the County Primary School was transformed into a perfect self-contained shopping centre, representative of every type of business in the town, including the finished fabrics of Courtaulds, Ltd., Flint—*i.e.*, terrylene and rayon materials.

The gas appliance section had on view every kind of cooker, including those with the new eye level grills, the live water washing machines, fires, space heaters, café equipment, and plastic models of bakers' ovens.

During the three days of the Exhibition, the gas appliance section was exceptionally well attended and also the washing and cooking demonstrations, and the Gas Council film show, which was open as one continuous programme from 6 to 8.30 p.m. There were over 2,500 visitors during the three days. It is hoped to make this an annual fair, if accommodation can be obtained.

EAST LANCASHIRE PIPELINE

Work has just finished on a 12-mile-long pipeline linking together manufacturing and gasholder stations at Burnley, Brierfield, Nelson, Colne, Barnoldswick, and Earby in the East Lancashire Group of the North Western Gas Board, after more than three years spent on the project. Many natural and man-made obstacles had to be surmounted during this period. These included a canal at Burnley, a river at Colne, and a railway track at Brierfield.

The latest issue of the Board's magazine, *Link Up*, says a good example of the 'know-how' which had to be shown by the Board's engineers is provided by the way in which the pipeline was made to cross a railway bridge in Colne: because there was not enough room to accommodate a standard 15 in. diameter pipe, an oval shaped pipe of the the same carrying capacity had to be used. The main varies in size from 8 in. to 18 in. in diameter and had cost approximately £180,000. Gas can be introduced into this new grid pipeline by means of existing compression plant at Colne, new compression plant recently installed at Brierfield, and by the end of this year by new plant to be fitted at Burnley. The pipeline can supply any of the stations along its length and will also reinforce small districts en route.

The importance of this new gas grid lies in the fact that it will now be possible to use gas-making plant at its maximum efficiency by operating the major part of it at a constant load. The pipeline also enables mutual assistance to be given in any case of breakdown and allows proper maintenance to be carried out at the linked stations without jeopardising the gas supply to the districts they serve.

Soon the pipeline will be extended to the Padiham works in order to supplement its manufacturing capacity and enable it to provide the large increased load required for the new Mullard factory at Simonstone.

Another item of technical news from the East Lancashire Group is that work is shortly to commence on cleaning out the crude gas main from Burnley to Altham Coke Ovens. This main is to be extended to Great Harwood and will then be able to move clean gas from Burnley to Great Harwood, or vice versa. This extension will link together the gas grids of the former Burnley and Blackburn Groups.

FAULTLESS PERFORMANCE

FLAWLESS APPEARANCE...

As the skating star's faultless performance and flawless appearance delight her critical audience, so the faultless performance and flawless appearance of the Century Cooker delight the critical housewife . . . as the star's perfect skating is the result of years of training and practice, so the Century is the result of R. & A. Main's years of experiment and research.

Always to the forefront in improving the efficiency of the gas cooker, R. & A. Main Ltd. have been "first in the field" with many outstanding features . . . in 1922 Main introduced the simplified form of cooker construction . . . in 1927 Main were first with an all-enamelled cooker . . . and in 1935 Main introduced the first all-sheet metal cooker.

The No. 20 Cooker was the first chassis-less model to be produced and marketed in Britain, and it was also the first cooker to incorporate an oven-flue vent discharging in front of the backplate. The high efficiency and popularity of the Century has indeed proved the worth of Main's years of constant research.

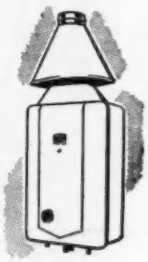
MAIN No. 20 CENTURY GAS COOKER

C3

Note the name-made by MAIN

R. & A. MAIN LIMITED
LONDON and FALKIRK

there is a MAIN water heater for every domestic purpose . . .



instantaneous for a complete household service . . . the M.I. Multipoint

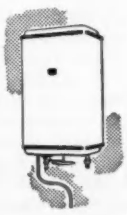
instantaneous for the bath . . . the New Junior

instantaneous or storage

for a complete household service . . . the G.L.C. Circulator

storage for a complete household service . . . the Thermain No. 15

storage for the sink or lavatory basin . . . the Thermain No. 2



MAIN WATER HEATERS Ltd.
Gothic Works, Thornton Rd., Croydon, Surrey
W13

'Operation Rescue'

The National Housing and Town Planning Council Conference and Exhibition was held on October 27-29. Among the exhibitors, the stand of Radiation Ltd., emphasised the theme of 'Operation Rescue' whereby efficient hot water, cooking, and space-heating may be inexpensively brought into 4 mill. homes were normal domestic facilities are lacking.

C12S circulator and 6H/20 cylinder, installed under the draining board in a pre-1939 council house.

The Parkray 2 free-standing convector fire with boiler introduces a new conception of room heating and provides all hot water needs, with an efficiency of over 50% on solid fuel use—about a third better than an ordinary open fire with back boiler. Nearly all the smoke which would ordinarily be belched through the chimney is drawn down through the fuel bed and consumed.

Radiation were also showing a gas water heating unit, the U.D.B., whereby a small New World circulator is fitted to an insulated cylinder to make a hot water installation to fit under a draining board, filling a space which is not normally used. These two appliances are among many which Radiation Ltd., are contributing to the rescue of 4 mill. homes—and 4 mill. harassed housewives.

Business Travel Season Tickets.—British Railways introduced on November 1 a new travel facility—business travel season tickets. Any firm or undertaking making a direct payment to British Railways of £5,000 a year in merchandise rail charges will be eligible for one of these tickets, which will be available for an unlimited number of journeys over a route or group of routes (at the holder's choice) covering not less than 100 miles. The cost will be about 25% less than an ordinary season ticket over the same routes. A further ticket may be purchased against each additional freight payment at £5,000 a year by the same firm.

Fifty Years of Building Education

Mr. Nigel Birch, O.B.E., M.P., Minister of Works, opened the London County Council Brixton School of Building exhibition at the Building Centre, Store Street, London, W.C.1. on November 11. Called 'Fifty Years of Building Education', the exhibition marks the school's jubilee and remains open until December 1.

Mr. Birch said it was his Ministry's aim to keep the building industry at a high and stable level of activity. 'And no one who lives in London or any other bombed city could doubt that a great many opportunities lie before everybody connected with the building industry.' he said. Referring to the effects of the last war on our cities, Mr. Birch emphasised that 'to get fine buildings put up we have got to have the trained men and the knowledge.'

Presiding at the ceremony was Mr. Victor Mishcon, Chairman of the L.C.C. The exhibition was entirely designed and presented by the staff and students of the school and case histories of students are used to focus attention on social and educational developments.

For the purposes of presentation, the period is divided into three parts, 1904-1919, 1919-1939, and 1939-1954. Each part is introduced by a series of photographs illustrating the buildings erected at that time and by a display of building craft-work typifying the nature of building work involved. These exhibits, aided by decorative touches such as a panel of wallpaper, create a strong sense of period and effectively divide the display into its three parts.

Manchester Juniors at Stretford

The 56th Annual General Meeting and President's Day of the Manchester District Junior Association of Gas Engineers was held at the Stretford works of the North Western Gas Board, on October 23, when Mr. H. Butters, Member of the Board, extended a welcome.

During the course of the meeting, Mr J. Oates, the outgoing President, presented the F. Johnston Prize to Mr. K Morris-Ashton for a paper entitled 'The Performance of a Hot Gas Mechanical Producer.'

The Silver Medal of the Society of British Gas Industries was presented by Mr. R. P. Glover, on behalf of the Society, to Mr. D. B. Stokes for a paper 'Thoughts and Ideas on Retort House Practice.'

At this stage Mr. A. H. Barrington was installed as President of the Association for the Session 1954-55 by Mr. Oates, who expressed the hope that he would have a happy and successful year of office. Mr. Barrington replied, and presented the Past President's Medallion to Mr. Oates.

Mr. Barrington then gave his Presidential Address. Mr. H. Partington, Senior Vice-President, proposed a vote of thanks, this being seconded by Mr. T. Nicklin, Junior Vice-President.

During the afternoon members inspected the Stretford works, after which they were entertained at tea by the North Western Gas Board.

A toast was given by the President to Mr. J. T. Haynes, Immediate Past President of the Institution of Gas Engineers, to which Mr. Haynes replied.

WOMEN'S GAS FEDERATION AT URMSTON

A new branch of the Women's Gas Federation was opened in the Gas Service Centre at Urmston in the North Western Gas Board's Manchester Group on November 4. The new branch will provide a forum where housewives from the busy industrial region around Urmston will be able to meet to discuss matters of housecraft.

Guest of honour at the opening of the new branch was Dame Vera Laughton Mathews, D.B.E., Chairman of the Federation,

'Our object is spiritual as well as practical,' said Dame Vera. 'The Federation seeks to improve the nation's home life not only by supplying its members with the latest information on scientific home management but also by providing facilities for discussions on the more spiritual side of life.'

The Chairman of the new branch is Councillor Mrs. Royle-Higginson, J.P., and Mrs. C. H. Sofe, wife of the Chairman of the Urmston Urban District Council, is its President.

Our picture shows Dame Vera Laughton Mathews speaking at the inaugural meeting of the new branch.

TRADE NEWS

Retort temperature measurement —the 'Optix' pyrometer

The 'Optix' pyrometer which is extensively used on the Continent for quick and accurate temperature checking is now being distributed in this country.

This instrument is distinguished from other opticals by a unique modern design and construction which combines all the necessary mechanical, electrical and optical components in one casing similar to a telescope. The makers add that careful design has ensured that all controls are positional for convenient handling. The constant brightness lamp is operated from a standard 4.5 volt torch battery and as this lamp has a

current consumption of only 50 milliamps, the battery has a long life. Lamp current is adjustable so as to ensure that the gradual drain on the battery does not affect the accuracy of readings, where the instrument is used for long periods. Two focussing adjustments are provided, one for the lamp image, and the other for the distance between instrument and the temperature source. Both these controls can be operated whilst holding the instrument in the measuring position. The standard instrument has a double range, viz., 750°C. and 1100°C., and again the range change switch is readily accessible when operating the instrument. A valuable feature is the provision of two spare lamps which are stowed in the lid of the carrying case.—*Elliott Brothers (London) Ltd., Research Laboratories, Elstree Way, Boreham Wood.*

Plessey multi-way connectors

Growing interest in unit construction in the electronic and light engineering fields has led Plessey to make a new range of multi-way connectors giving 20-way, 30-way, 40-way, 60-way and 80-way linkages. These connectors, which are small and light-weight, find many uses in modern multi-unit assemblies as in field telephones, signalling apparatus on railways, and in fact wherever inter-unit linkage is needed.

The plugs and sockets of these connectors are very compact, each being contained within a rectangular aluminium case. Units may be packed closely together on a chassis or panel. All units are constructed from high-grade aluminium and are small, light and easy to handle.

The plug and socket contacts are silver plated and so made as to provide positive connection when fully engaged but giving a self-ejecting action when being disconnected. This ensures the lowest possible contact resistance—an essential feature in speech, V.F. or control circuits—and does not impair the easy withdrawal of the plug from the socket. Contacts are recessed within their respective housings as a protection against mishandling.—*The Plessey Co., Ltd., Ilford, Essex.*

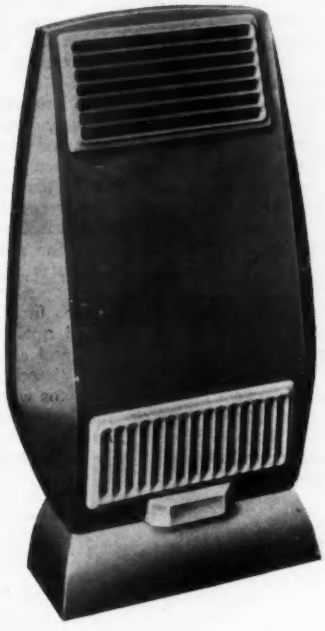
Improved New World Merlin heater

The Merlin space heater No. 678 was first presented in the 1950 heating season when its novel shape and pleasing appearance won instant popularity. Research and district experience over three heating seasons have led to an improved design, the Merlin No. 378. The overall form of the heater has been retained but the grilles through which air enters and leaves have been completely changed to give improved appearance and to facilitate cleaning. Both grilles are smooth castings finished in glossy vitreous enamel to tone with the rest of the heater. They can be dusted or cleaned in position but if preferred can be removed and washed; they are retained by concealed spring clips and can be released easily.

A new feature on the front of the heater is a small hood, vitreous-enamelled to match the grilles, concealing the mouth of the flash-ignition tube. The outside casing and the base are finished in stoved paint.

The Merlin has a handle fixed to the back so that it can be carried from room to room. Alternatively the heater may be fixed securely to the floor and concealed brackets are provided inside the base for this purpose. With its modest gas rate the Merlin is intended for flueless use.

The internal construction is such that the outside surfaces are prevented from becoming overheated. A new feature,



the subject of a patent application, provides for controlled dilution of the hot gases with air before they leave the heater, so avoiding extremes of temperature. The internal changes have increased the rate at which air flows through the heater so that it is much more effective although the nominal rating remains unchanged at 6,000 B.Th.U./hr.—*Radiation Group Sales, Ltd., Radiation House, 7, Stratford Place, London, W.1.*

New Argonaut welding application

Experiments to prove a new application of Argonaut welding equipment manufactured and marketed throughout the British Commonwealth by The British Oxygen Company, in use with mild steel, have recently been carried out by this Company and the United Steel Companies.

The process has until recently been confined chiefly to light alloys, though it has also been employed on stainless steel and copper base alloys. This new development of the Argonaut is claimed to be a great step forward.

It has been found satisfactory for welding certain qualities of carbon steels in all positions with the exception of vertical fillet and butt welds. The advantage given by Argonaut over metallic arc welding is higher deposition rate and consequently greater speed (as much as 40%).

A number of tests showed that the porosity problem could be overcome with the proper technique. Sound

welds of proper strength and metallurgical quality were obtained in semi-killed boiler quality steel and fully killed pressure vessel quality steel. It has also been found that the metal deposited in butt welds in these steels has a greater strength than the parent metal, both in the as-welded and stress-relieved conditions. The tensile strength of the weld specimens is quoted as 36 tons per sq. in. as deposited, and 34 tons per sq. in. stress relieved, while the bend tests show adequate ductility.

The process uses a shielded arc with a direct current of relatively high amperage (50,000 amps per sq. in. minimum), on a continuously fed bare wire electrode of small diameter. The manner of metal transfer by projection across the arc permits welding in all positions, saving those mentioned above for mild steel, and these last two attributes give the process a large field of application on all types of fabrication. No flux is needed and welds are of good quality, free from slag and inclusions, and also, of course, there is complete freedom from post-weld corrosion problems when welding light metals or stainless steel. —*The British Oxygen Company, Ltd., Bridgewater House, Cleveland Row, London, S.W.1.*

Improved tractor shovel bucket

One of the Allis-Chalmers H.D.5G's recently imported by Mackay Industrial Equipment, Ltd., was the first of these machines to be fitted with a newly designed bucket. This bucket is rated at 1¼ cu. yd. capacity and has a heaped capacity of 1½ cu. yd.

The back sheet of the new bucket has been brought further forward at the top and the spill guard extended, reducing the chance of spillage over the back of the bucket. The back of the new bucket is smooth and has no ledges where earth or sand can accumulate and fall on to the tractor when the bucket is raised.

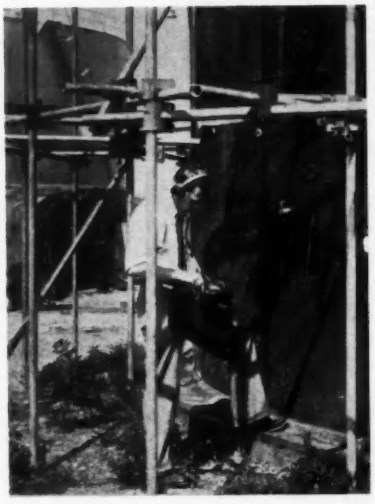
The rear of the bottom sheet of the new bucket is inclined at an angle of 7°. This results in a more gentle curve in the interior of the bucket and gives easier loading with less wear. Easier loading is also contributed to by the elimination of the angle piece formerly used on the inside of the bucket back sheet at the base of the spill guard.

Dumping has never been a problem on H.D.5G's, because the operator can bang the dumping ram linkage against the stops on the lift booms, but the increased angle of the bottom sheet will give even easier dumping. It will also increase the depth of the box section in the bottom of the bucket and therefore give greater rigidity.

The Allis-Chalmers H.D.5G was the first successful tractor shovel to be put on the market and a large number have been working in Britain since 1948. Over the years a number of improvements have been made though the basic design has remained unchanged. This latest improvement is the result of the continuous study of Tracto-Shovel operation by the manufacturers.—*Mackay Industrial Equipment, Limited, Faggs Road, Feltham, Middlesex.*

Dawe ultrasonic thickness gauges

Our picture shows the Dawe ultrasonic thickness gauge in action at the Coryton Oil Refinery of the Vacuum Oil Company. The tank has been 'weathered' and the gauge will determine its thickness before painting operations. The range of 'resonance' ultrasonic thickness gauges will obviously depend on the frequency range through which the signal can be varied. In the gauge illustrated, the frequency range provided enables measurements to be taken on steel from $\frac{1}{16}$ in. up to 12 in. and *pro rata* in other materials. By raising the frequencies



available and so decreasing the wavelengths of the signal, a gauge working on the same principle has recently been made available covering the range for 0.02 in. up to 4 in. in steel.

In many respects sound waves behave just like light waves; in ultrasonic testing and gauging the property of reflection is especially important. Whenever a signal travelling in a medium meets a discontinuity in the medium, it will be reflected wholly or partly, depending on the nature of the discontinuity, just as light is completely reflected by a mirror and only partly by a pane of glass.

To measure the thickness of a component, the ultrasonic signal injected into the specimen by means of a crystal probe is varied until the wall thickness of the specimen at that point is a multiple of the wavelength of the signal. Under these circumstances the portion of the ultrasonic wave reflected from the far face of the specimen will reinforce the injected wave and cause the resultant signal to be greatly increased in amplitude. In other words, the outgoing and reflected waves are 'in phase' with each other and the specimen acts as a resonator at that frequency. As the incidence of this condition of resonance can be indicated by a sharp increase in a humming noise in the operator's head-phones, or by the indication on the meter, the thickness of the unknown specimen can be calculated if the signal frequency and the speed of the waves in the material are known. The ultrasonic wave travels at the same velocity as sound in the material so that, if this figure is known, the wavelength of the signal can be computed from its frequency. *Dawe Instruments, Ltd., 99, Uxbridge Road, London, W.5.*

Lightweight Pescara-Muntz compressor

Considerable interest was aroused recently when Mackay Industrial Equipment, Ltd., announced their appointment as concessionaires for the British made Pescara-Muntz Free-Piston Compressor. Mackay now announce that a lightweight model of this compressor, the P.42H, has now been produced. This has, like the standard P.42H, an output of 105 cu.ft. F.A.D. at a maximum operating pressure of 100 lb./sq. in. The differences between the two are in the chassis and canopy.

Incorporated in the chassis of the standard P.42H are two supplementary air receivers, which together with the 1 cu.ft. capacity primary receiver, give a total receiver capacity of 6 cu.ft. The constant adjustment of output which is characteristic of free-piston compressors, and this additional receiver capacity, enable the compressor to supply sufficient air for the intermittent operation of tools requiring an output far in excess of 105 cu.ft.

The chassis of the lightweight model is of lighter construction and does not incorporate additional air receivers. It is also fitted with smaller tyres. On the standard model P.42H there is lock-up cupboard accommodation for a complete set of contractors' pneumatic tools and two hoses. The canopy of the lightweight model does not include this space. The engine and all the working parts are exactly the same in both models.

The lightweight model is smaller and lighter (weight 3,024 lb.) than the standard model and it is therefore more easily manhandled and towed. It is also cheaper. Both the standard and the lightweight models can be supplied without towing equipment, road wheels and springs, for lorry mounting or for use as stationary compressors.—*Mackay Industrial Equipment, Ltd., Faggs Road, Feltham, Middlesex.*

Bribond resistant board

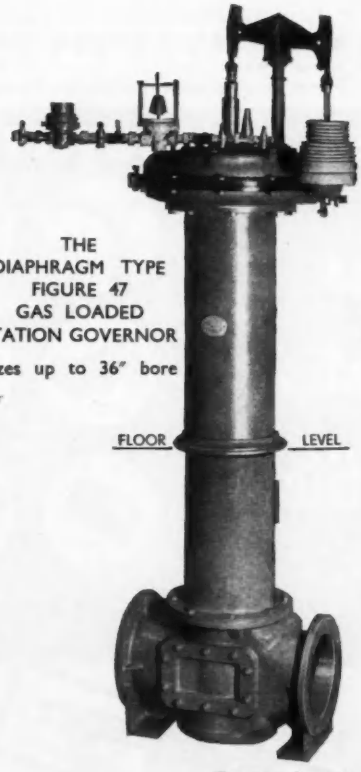
Bribond is a resin bonded board resistant to acid, alkali, heat, blast, moisture and vermin. All kinds of signs, plans, drawings and photostats, and similar items of equipment, when 'Bribonised,' will remain clear and legible indefinitely, say the makers.

Being slightly flexible, Bribond will withstand the effects of colliery shot blasting and other industrial hazards. It is particularly ideal for signs and notices in collieries and public baths, industrial canteens and in industry generally where there are similar conditions of heat and fumes. It can be made in translucent form, and supersedes glass for illuminated signs. Another advantage is that it withstands high voltages.—*Brighton Laminations, Ltd., 49, North Street, Portslade, Sussex.*

Peebles & CO. LTD.

FOR ALL SIZES AND TYPES OF GOVERNORS

DIAPHRAGM CONTROL VALVES, AUTOMATIC BY-PASS VALVES, METER PROTECTION VALVES, HOLDER FILLING VALVES, THERMO RELAY VALVES, CUT-OFF VALVES, GAS METERS



THE DIAPHRAGM TYPE FIGURE 47 GAS LOADED STATION GOVERNOR

Sizes up to 36" bore

SINGLE-BEAT VALVE GOVERNOR FIGURE 98 (BALANCED) PATTERN

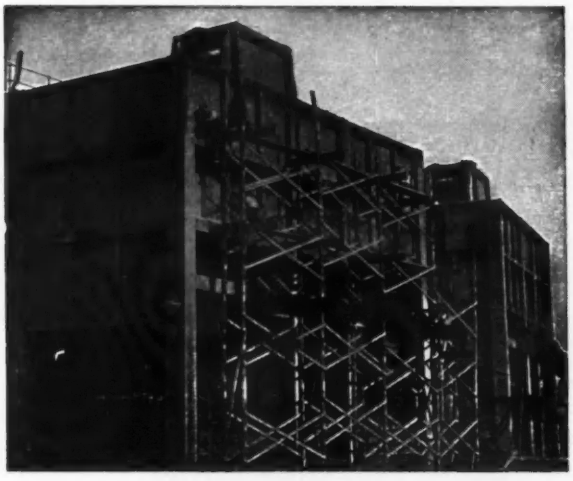
THE WEIGHT-LOADED FIGURE 109 DOUBLE-BEAT VALVE GOVERNOR

Comprehensive list of products on application

TAY WORKS, WEST BOWLING GREEN STREET,

'Phones: LEITH 36544 & 35069. EDINBURGH, 6 'Grams: "TANGENT, EDINBURGH."

Gunite



One of the reinforced concrete structures reconditioned with Gunite for the City of Carlisle Gas Undertaking.

Gunite—concrete applied by air pressure—has numerous applications where its great density and extreme adhesion have exceptional value.

For repairing reinforced concrete it has particular merit, as, due to the method of application, a uniform density and adherence is obtained whenever Gunite is applied.

For lining coal bunkers and steel chimneys it possesses great resistance to corrosion and protects steel-work from the abrasive action of coal or coke.

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THE BRITISH ROTOTHERM CO., LTD.

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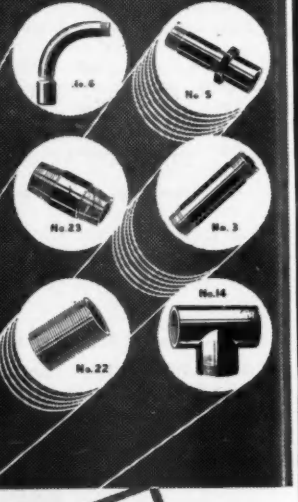
FOR

Gas, Water & Steam



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RUSSELL BROS (WALSALL) LIMITED

BRADFORD TUBE WORKS · WALSALL · ENGLAND

The Bradford Tube Works occupies a factory area of some three acres exclusively devoted to the manufacture of Steel Tubes and Fittings.

Contractors to Admiralty and War Office. Extensive stocks.

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The Fry's Solder produced exclusively for Gas Meter manufacture

G.M. and "G.M.1" are the Gas Meter solders by FRY'S which have been developed especially for use in gas meter production and repair. The use of the "G.M." Solders with a suitable FRY'S Flux ensures swift — *economical* production and a safe, reliable joint. Other FRY'S soldering products of interest to the industry are FRYOLUX Solder Paint for all forms of tinning and sweat soldering and Blowpipe strip for fine work. But for all forms of soft soldering, there's a FRY'S product — often produced exclusively for the process. Why not write for full details of the FRY'S range of solders *now?*

? can we help you

The FRY'S team of solder experts are readily available to solve any problems you may have concerning soldering. We look forward to hearing from you.

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Tandem Works, Merton Abbey, S.W.19. Telephone: MITcham 4023

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28

Over a Million

DRESSER
STYLE 60 adjustable leak clamps

have been installed

BY GAS AND WATER UNDERTAKINGS THROUGHOUT THE WORLD

during the past 50 years!

This is a claim that can be substantiated. It is ample proof that Dresser Style 60 Leak Clamps never fail to provide a PERMANENT method of stopping escapes at socket and spigot joints. DRESSER CLAMPS are UNSURPASSED for reliability.

You MUST have the BEST – this name means that you get it!

Available in sizes from 2½" to 48"
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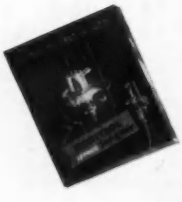
FWS36

Precision Manufacture
is the answer

Why do Gas Engineers specify the Monitrol Automatic Shut-off Valve? One reason is that the design and methods of manufacture of the Monitrol are based on the specialised American experience of the Robertshaw-Fulton Controls Company.

MONITROL
AUTOMATIC
Shut off VALVE



Send for this informative, fully illustrated booklet describing the construction, operation and installation of the Monitrol Valve Thermo-Couple and Pilot Burner.

Produced in co-operation with the Robertshaw-Fulton Controls Company U.S.A.

Manufactured throughout in an air-conditioned factory.

High precision components instrument assembly techniques employed.

Magnet surfaces ground to flatness limits never before achieved in quantity production

MONITOR ENGINEERING & OIL APPLIANCE LTD. STECHFORD, BIRMINGHAM 33. *A Member of the Parkinson & Cowan Group.*

PUBLISHERS' NOTICE

The " Gas Journal " is published every Wednesday, price 1/3d.; by post 1/5d.

Subscription Rates: Home and Empire:—52/- per annum; Foreign:—60/- per annum. (Both payable in advance.) A copy of the " Gas Journal " Calendar & Directory is presented each year to continuous subscribers.

Classified Advertisements: All small classified advertisements are charged at 1/9 per line (approx. 7 words)—minimum charge 10/6. A Box Number address occupies 2 lines, and a further 6d. is charged towards cost of postage on replies. Copy must be received by first post on Monday to ensure insertion in that week's Journal.

Displayed Advertisements: Rates obtainable on application to the Business Manager. Change of copy for displayed spaces must be received 14 days prior to publication if proofs are required. Type area of inside pages 10 in. deep × 7 in. wide; block screen 120.

BUSINESS MANAGER: S. T. CULLEN

MIDLANDS MANAGER: G. B. Torrance, 42, Wychall Lane, King's Norton, Birmingham, 30. *Telephone:* Kings Norton 3868

NORTHERN MANAGER: Philip W. B. King, Flat 1, 7 Langcliffe Avenue, Harrogate. *Telephone:* Harrogate 67625.

SOUTHERN REPRESENTATIVE: A. Engelhardt, 11, Bolt Court, Fleet Street, E.C.4. *Telephone:* Central 2236-7

WALTER KING, LTD., 11, Bolt Court, Fleet Street, London, E.C.4.

Telephone: CENtral 2236-7. *Telegrams:* Gasking, Fleet, London.

MANUAL OF GAS FITTING

by R. N. Le Fevre

Temporarily out of print

A reprint of this most popular text book, incorporating numerous modifications and additions by the author, is in hand and we anticipate copies will be available by the end of the year.

Orders received are being listed, and will be executed in strict rotation.

WALTER KING, LTD., 11, BOLT COURT, FLEET STREET, LONDON, E.C.4.

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DUTCH AND DANISH BOG ORE SPECIALLY ACTIVATED OXIDE OF IRON

Oxide supplied on loan or sale outright. Highest prices paid for Spent Oxide

Send your enquiries to

GAS PURIFICATION & CHEMICAL COMPANY LIMITED

ESTABLISHED 1873

PALMERSTON HOUSE, BISHOPSGATE, LONDON, E.C.2.

Telegrams: "Purification, Stock, London." Telephone: London Wall 5077

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NU-SWIFT!

Hot and humid conditions test fire extinguishers severely. Corrosion threatens, metals expand and contract. Reliable Nu-Swift remains reliable under trying conditions.

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In Every Ship of the Royal Navy

"KLEENOFF" *

THE COOKER CLEANER

"KLEENOFF"

FIBRE BRUSHES
RUBBER MOPS

"KAY-DEE" *

KETTLE DESCALER

For resale to the public, and in bulk for Works use.

BALE & CHURCH, LTD.

7, CROMPTON WAY, CRAWLEY, SUSSEX

APPOINTMENTS VACANT

The engagement of persons answering these advertisements must be made through a Local Office of the Ministry of Labour or a Scheduled Employment Agency if the applicant is a man aged 18-64 inclusive or a woman aged 18-59 inclusive unless he or she, or the employment, is excepted from the provisions of the Notification of Vacancies Order, 1952.

FLAVELS of Leamington have a vacancy in their Research Laboratory for a PHYSICIST or PHYSICAL CHEMIST, mainly connected with gas water heating. University degree or equivalent desirable but not essential. Apply, stating salary required, to the Technical Director, Sidney Flavel & Co. Ltd., Leamington Spa.

DEVELOPMENT AND DESIGN ENGINEER required for large firm of domestic appliance manufacturers in Midlands. Practical knowledge of foundry machine and presswork essential, also technical knowledge of combustion testing of gas appliances. Candidate must be capable of taking complete charge of drawing office, test room and experimental workshop. Apply: No. 217, *Gas Journal*, 11, Bolt Court, Fleet Street, London, E.C.4.

SCOTTISH GAS BOARD
GLASGOW DIVISION
GLASGOW DISTRICT
HOME SERVICE ADVISER
A.P.T. IV/V (Prov. 'A') £268-£464

APPLICATIONS are invited for the post of HOME SERVICE ADVISER. Candidates should be in possession of a recognised Domestic Science Diploma and must be capable of conducting demonstrations and lectures in public, and have had experience of advising consumers on the use and care of appliances.

The salary of the post will be within Grade IV/V (Provincial 'A') £268-£464 per annum, and placing will be according to qualifications and experience. The post is pensionable and the successful candidate may be required to pass a medical examination.

Applications endorsed " H.S.A." stating age, qualifications, present position, etc., should be submitted to the undersigned not later than fourteen days after the publication of this notice.

D. F. YOUNG,
Divisional Controller

30 John Street,
Glasgow, C.1.
November 12, 1954.

SCOTTISH GAS BOARD
GLASGOW DIVISION
GLASGOW DISTRICT
ASSISTANT NEW BUILDINGS REPRESENTATIVE
A.P.T. VII (Prov. 'A') £585-£665

APPLICATIONS are invited for the position of ASSISTANT NEW BUILDINGS REPRESENTATIVE in the Glasgow District.

Candidates should be qualified to undertake negotiations with Local Authorities, Architects and Builders concerning supplies, service arrangements, carcassing, installation of appliances, and the preparation of specifications and estimates from plans.

The salary will be within the Grade A.P.T. VII, (Provincial 'A') £585-£665 per annum, and the successful applicant may require to undergo a medical examination and join the Board's Pension Scheme.

Applications endorsed 'Asst. N.B.R.' giving full details of age, experience, qualifications and present position, should be received by the undersigned not later than fourteen days after the publication of this notice.

D. F. YOUNG,
Divisional Controller

30 John Street,
Glasgow, C.1.
November 12, 1954.

(Classified advertisements continued on page 494)

APPOINTMENTS VACANT (ctd.)

DRAUGHTSMEN required, preferably with experience in Steel Structures, Pipework, Foundations or Refractories. Write, stating full particulars and salary required to: The Chief Draughtsman, Furnace Department, The Wellman Smith Owen Engineering Corporation Ltd., Parnell House, Wilton Road, London, S.W.1.

WEST MIDLANDS GAS BOARD

BIRMINGHAM AND DISTRICT DIVISION
DRAUGHTSMAN

THE PERSON appointed will be responsible to the Divisional Engineer and should hold a Higher National Certificate in Civil or Mechanical Engineering, or an equivalent qualification. He must have had good Drawing Office experience.

The post is pensionable and the successful candidate may be required to pass a medical examination.

Applications, stating age, experience, qualifications and salary required, should be addressed to Mr. J. E. Wakeford, Divisional General Manager, West Midlands Gas Board, Birmingham and District Division, Gas Offices, Edmund Street, Birmingham, 3, to reach him within fifteen days of the appearance of this advertisement.

F. H. CURETON,
Secretary to the Board.

WALES GAS BOARD

PONTYPRIDD UNDERTAKING
WORKS FOREMAN

APPLICATIONS are invited from suitably qualified persons for the position of WORKS FOREMAN to the Pontypridd Undertaking.

Candidates should have experience of Coke Oven Gas Supplies and of Water Gas Manufacture, and be able to satisfactorily control labour.

The salary will be in accordance with A.P.T. V (£500-£580). The post is pensionable.

A house is available at a reasonable rental.

The successful candidate will be required to pass a medical examination.

Applications stating age, qualifications and experience, together with the names of two referees should reach the undersigned not later than fourteen days after the appearance of this advertisement.

DAVID MUIR,
Engineer and Manager.

Gas Offices,
Treforest,
Pontypridd.

WALES GAS BOARD

HOME SERVICE ADVISER
PONTYPRIDD AND ABERDARE
VALLEY UNDERTAKINGS

APPLICATIONS are invited for the position of HOME SERVICE ADVISER for joint service with the above Undertakings.

Salary within Scale A.P.T. IV (£268/£420) per annum.

Candidates must be in possession of a recognised Diploma in Cookery and/or Domestic Science. They should be proficient in gas cooking, laundering and other domestic appliances.

Applications stating age, experience and present position and giving full particulars of training and qualifications, together with the names of two referees, should reach the undersigned within fourteen days of the publication of this notice.

DAVID MUIR,
Engineer and Manager.

Gas Offices,
Treforest,
Pontypridd,
Glam.

SOUTHERN GAS BOARD

COMMERCIAL MANAGER

APPLICATIONS are invited for the appointment of COMMERCIAL MANAGER to the Board at a commencing salary in the region of £2,500, according to qualifications and experience.

Applicants must have had extensive marketing experience and be capable of organising sales promotion campaigns for the development of the use of gas and coke for domestic, commercial and industrial purposes.

The successful candidate will be required to pass a medical examination and, unless already subject to a pension Scheme by virtue of the Gas (Pension Rights) Regulations, 1950, will be required to join the Board's Staff Pension Scheme.

Applications stating age, education, qualifications, training, experience, present appointment and salary, together with a one-page summary of these particulars, should be sent in an envelope marked "Commercial Manager" to the Secretary, Southern Gas Board, 164, Above Bar, Southampton, to reach him not later than November 30, 1954.

NORTH EASTERN GAS BOARD

HEAD OFFICE
TECHNICAL ASSISTANT—
INSTALLATIONS SECTION

APPLICATIONS are invited for the above position at the Head Office of the Board, at a salary within Grade A.P.T. VI (Provincial 'A') (£530-£610 per annum) of the Salary Scales agreed by the National Joint Council for Gas Staffs.

The work of this Section is mainly concerned with the examination and field testing of appliances and installation fittings and materials, and the study and drafting of Codes of Practice in connection therewith. The successful candidate will be required to possess such technical knowledge and qualifications (not less than the full Technological Certificate of the City and Guilds) and such practical experience as will enable him to assist in this work.

Applications giving age, qualifications, training and experience, should be sent to the Chief Commercial Officer, North Eastern Gas Board, Bridge Street, Leeds, 2, by November 29, 1954.

The successful applicant will be required to pass a medical examination and to participate in the Board's Staff Pension Scheme.

J. C. GARDNER,
Secretary.

Bridge Street,
Leeds, 2.
November 9, 1954.

NORTH WESTERN GAS BOARD

APPLICATIONS are invited for the following pensionable appointments :—

MANCHESTER GROUP
DRAUGHTSMAN—DISTRIBUTION DEPT.
(*Salary within Grade A.P.T. VII/VIII £585-£705 per annum*)

Applicants should have a knowledge of the design and layout of distribution plant, including boosting and governor systems and the maintenance of plan records. They should possess the Higher National Certificate of the Institution of Mechanical Engineers, or hold a similar qualification.

SHIFT ENGINEER—
ROCHDALE ROAD WORKS
(*Salary within Grade A.P.T. VII—£585-£665 per annum*)

Applicants should have practical knowledge of the operation and maintenance of vertical retorts, C.W.G. plants, and be capable of supervising general gas works plant operation.

CARBONISING ASSISTANT—
BRADFORD ROAD WORKS,
MANCHESTER
(*Salary within Grade A.P.T. VI £530-£610* per annum)

Applicants must have had experience in the maintenance, operation, and efficient working of all types of carbonising plants, and they will be required to carry out their duties under the direction of the Carbonising Superintendent.

Detailed applications, giving the names of two referees, should reach the General Manager, N.W.G.B. (Manchester Group), Town Hall, Manchester 2, within fourteen days.

EASTERN GAS BOARD

NORWICH DIVISION
KING'S LYNN DISTRICT

FIRST CLASS GAS FITTER required for the above Undertaking. Full J.I.C. rates (Provincial 'A') and conditions of service.

Accommodation for the time being will be available at Hunstanton at a reasonable rent, and during this period travelling expenses will be allowed.

The successful candidate will be required to pass a medical examination.

Applications giving details of age, present duties and references, should be made to the undersigned within fourteen days of the appearance of this advertisement.

L. C. B. WILLIAMS,
Group Manager.

Eastern Gas Board,
Gas Works,
King's Lynn.
November 9, 1954.

PLANT, Etc., FOR SALE & WANTED

FOR SALE FROM STOCK. Steel Framing for Building 91 ft. wide (in one clear span of 81 ft.) × 192 ft. long × 25 ft. to eaves. Doors, ends, glazing as required. Write for particulars, etc., Bellman Hangars, Ltd., Terminal House, London, S.W.1.

WANTED

ALWAYS BUYING Scrap Mercury and all grades precious and non-ferrous scrap metals, any form: keenest prices. Let us quote. Belgrave Buyers (G.J.), 5, Belgrave Gardens, London, N.W.8. MAI 7513.

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URBAN DISTRICT COUNCIL OF NEWRY

GAS DEPARTMENT
TENDER FOR SUPPLIES

THE GAS COMMITTEE of the above Council invite Tenders for the supply and delivery of specified quantities of *Galvanised Iron Tubing and Fittings, Brass Tubing and Fittings, Copper Tubing, and Sundry Requisites.*

Itemised Schedules of Materials and Form of Tender can be obtained on application from the Gas Offices, Kilmorey Street, Newry (N.I.).

Sealed Tenders, endorsed 'Tenders for Supplies' must be lodged with the undersigned not later than 12 o'clock noon on Monday, December 6, 1954.

J. COLLINS,
Manager.

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"Fishtail" type burner *with two-armed stamped pattern injector for heating liquid in tanks by submerged horizontal combustion tubes. For use with low pressure gas supplies.*
Size Range: *1", 1¼", 1½", 2" and 2½" outlets.*
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Note.—These four burner heads are for high pressure gas or low pressure gas and air blast.

Brass non-blow-off head types: *deal with 5 to 10 cu. ft. of gas per hour.*

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Perforated head type burner: *deals with 10 or 15 cu. ft. of gas per hour.*

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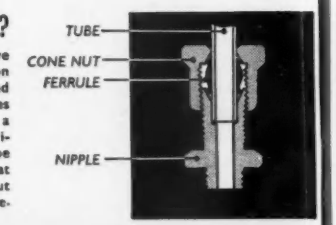

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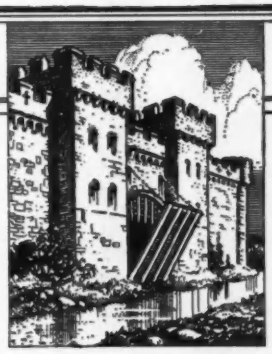

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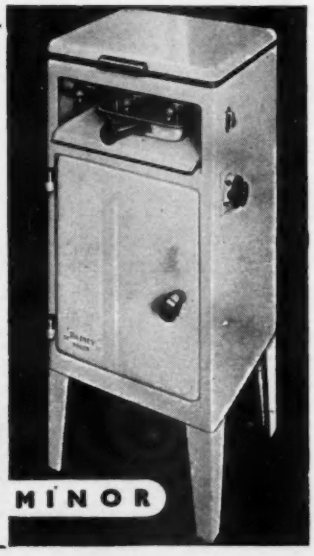

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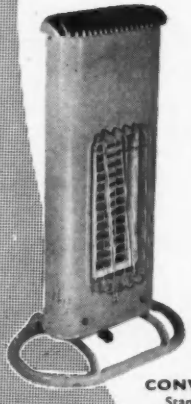

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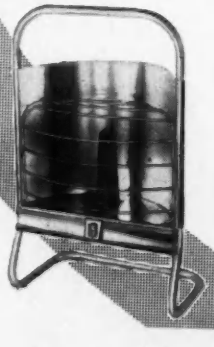

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